World Petroleum

JANUARY, 1949

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7 Reasons WHY IT'S WARREN

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3. FACILITIES
4. PRODUCTION
5. STORAGE
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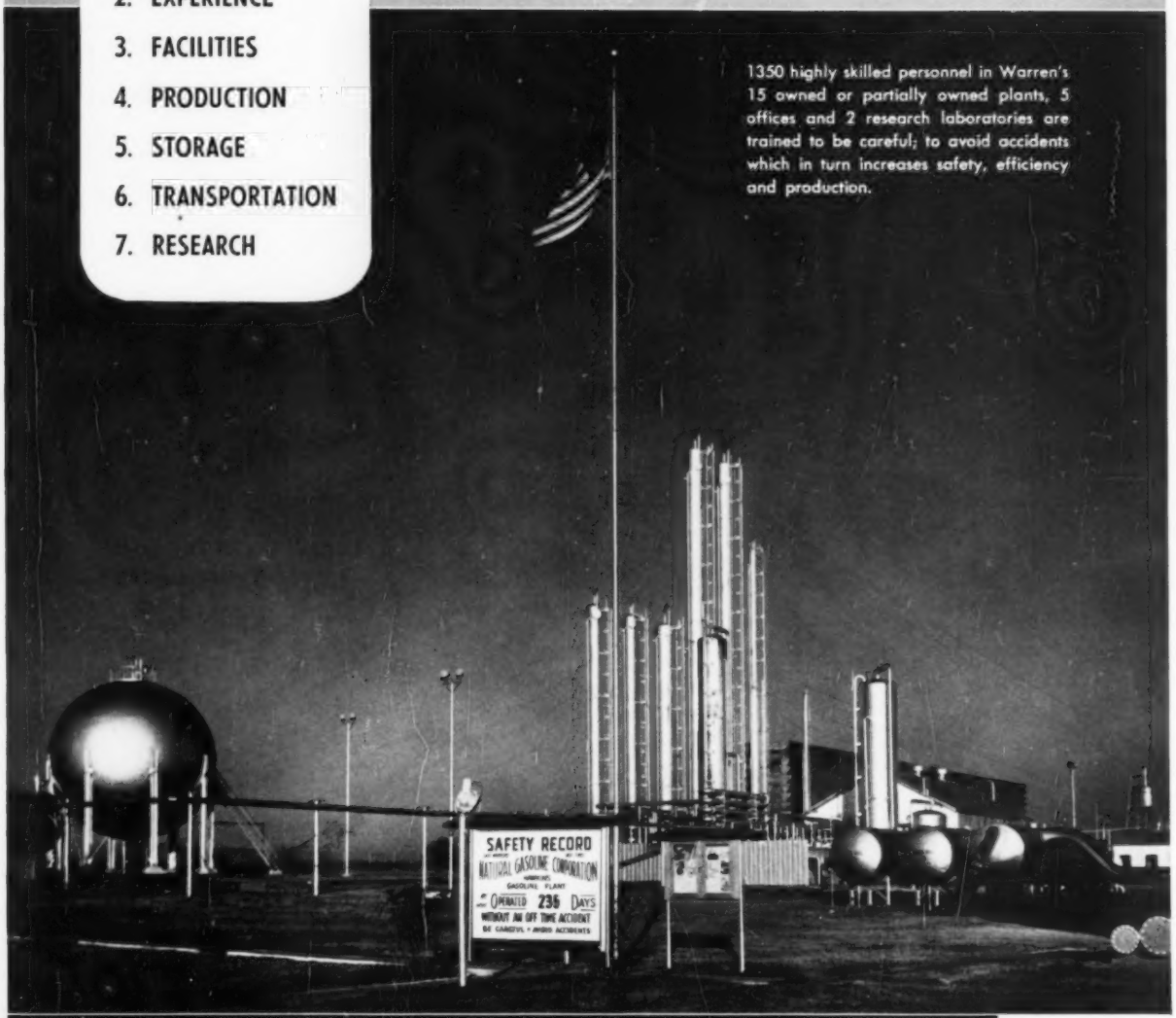
1350 highly skilled personnel in Warren's 15 owned or partially owned plants, 5 offices and 2 research laboratories are trained to be careful; to avoid accidents which in turn increases safety, efficiency and production.



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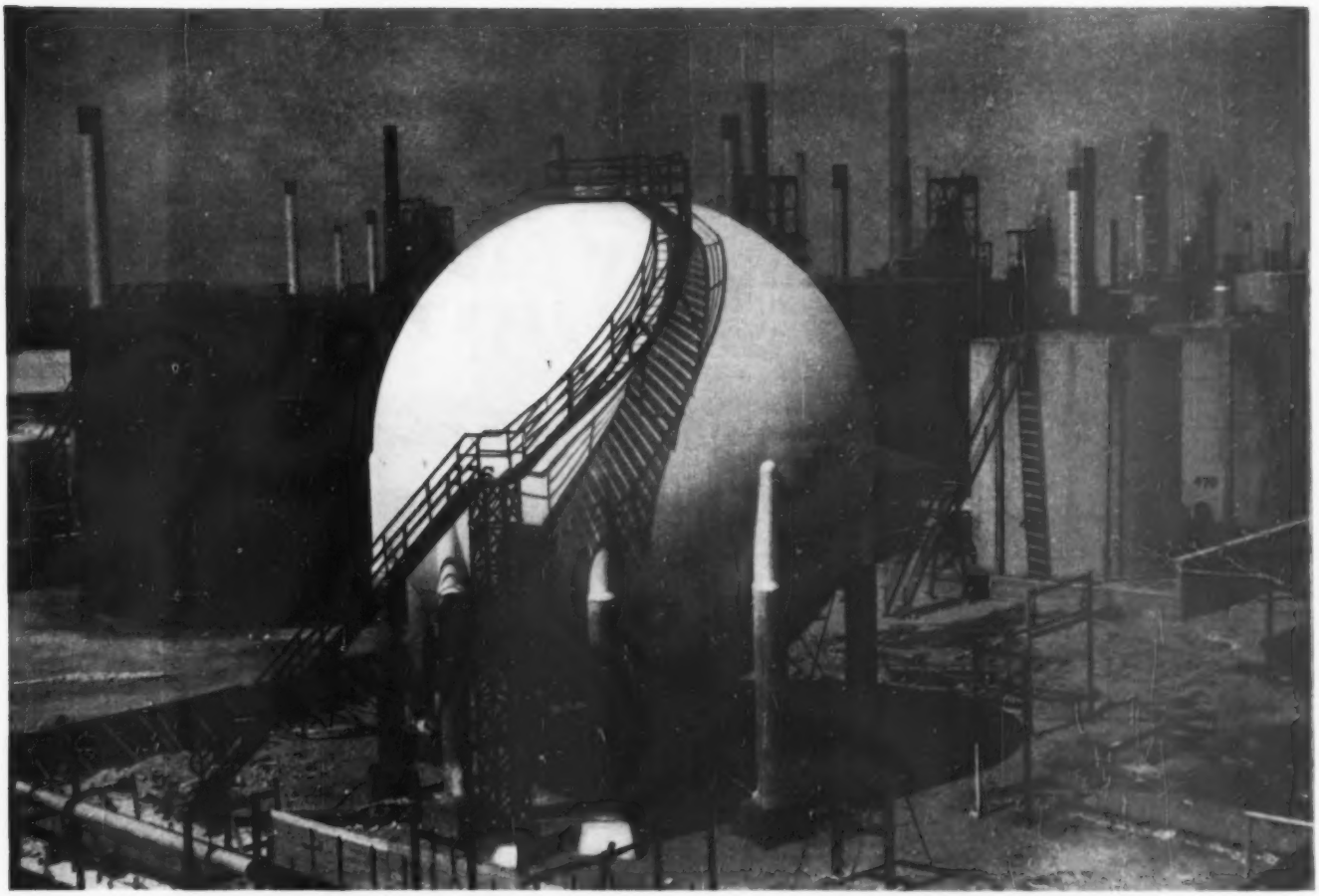
Crude Oil, Natural Gasoline and Liquefied Petroleum Products



POSITIVE PROTECTION
in Economical Form

HORTONSPHERES Here's a high pressure storage tank that offers every kind of protection you need—along with the indispensable protection against evaporation loss. First of all, there is protection against the danger of fire. Hortonspheres hold vapors *inside*, in a mixture which contains very little oxygen and is too rich to ignite. Then there's protection against interior corrosion—the same lack of oxygen which reduces fire hazard, also limits the amount of corrosion on the inner surface of the shell.

Hortonspheres have other advantages, too. They are a dependable type of pressure storage. Maintenance requirements are usually just a coat of paint applied regularly, (Note that all parts of the Hortonsphere are above ground and readily accessible.)

These storage units are built to store the more volatile petroleum products, such as butane and propane. Pressure settings range from 25 to 150 lbs. per sq. in., and capacities range from 1,000 to 25,000 bbls. Let our nearest office give you more details.

The Hortonsphere shown in the above view is 43 ft. 3 in. in diam., and operates at 50 lbs. pressure. It was erected for the Lago Oil and Transport Company, Ltd., at Aruba, Netherlands Antilles.

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Sales Offices: Chicago, Houston, Tulsa, San Francisco, Birmingham, Atlanta, Cleveland, Philadelphia, Los Angeles, Detroit, Boston, Seattle and Salt Lake City
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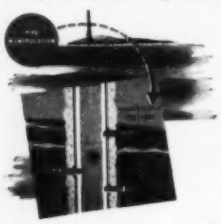
Whessoe, Limited, Darlington, England
Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
Horton Steel Works, Limited, Fort Erie, Ontario, Canada

The JOHNSTON SHOOT-N-TEST GUN PERFORATOR

Combines 5 Outstanding Features

for better gun perforating operation!

By selecting a Johnston Gun Perforator you get years-ahead Gun Perforator design for an easier, more economical method of perforating casing. In addition, this Gun Perforator serves as the perforating unit in *combined* "Shoot-n-Test" operations for the slickest possible way of obtaining water shut-off information, doing exploratory work or testing for actual production.



1 Safer Operating . . . because the Johnston Gun Perforator fires only when subjected to *both* in-the-hole hydrostatic pressure and definite top-hole pipe manipulation. You get safety in transporting and rig-floor handling and positive protection against premature firing on the run-in.

2 More Exact Positioning . . . because the Johnston Gun Perforator is tallied in on your own tubing or drill string – no guess work, no elaborate measuring devices . . . you connect the Gun Perforator on the bottom joint of pipe and run-in until actual pipe-in-the-hole tally spots unit opposite the formation to be perforated.

3 Simultaneous Fire of ALL Projectiles . . . because of the hydrostatic firing principle of the firing head and flash hole design of each perforating gun section, the firing of all chambers is virtually instantaneous and all projectiles are projected simultaneously . . . an important feature because *balanced* recoil increases penetration depth and assures proper spacing of perforations.

4 Field Car Portability . . . because the firing head, together with the number of perforating gun body sections selected for any particular perforating job can be easily transported in the back of a regular pick-up truck or field car. *After* arriving at the well location, the Gun Perforator can be assembled with standard hand tools.

5 Faster, Easier Maintenance . . . because of the minimum number of working parts in the firing head and the *few* expendable supplies required after each job. All expended supplies are easily replaced during normal reassembly after cleaning and drying the firing head and perforating gun sections.

WRITE today for descriptive literature!

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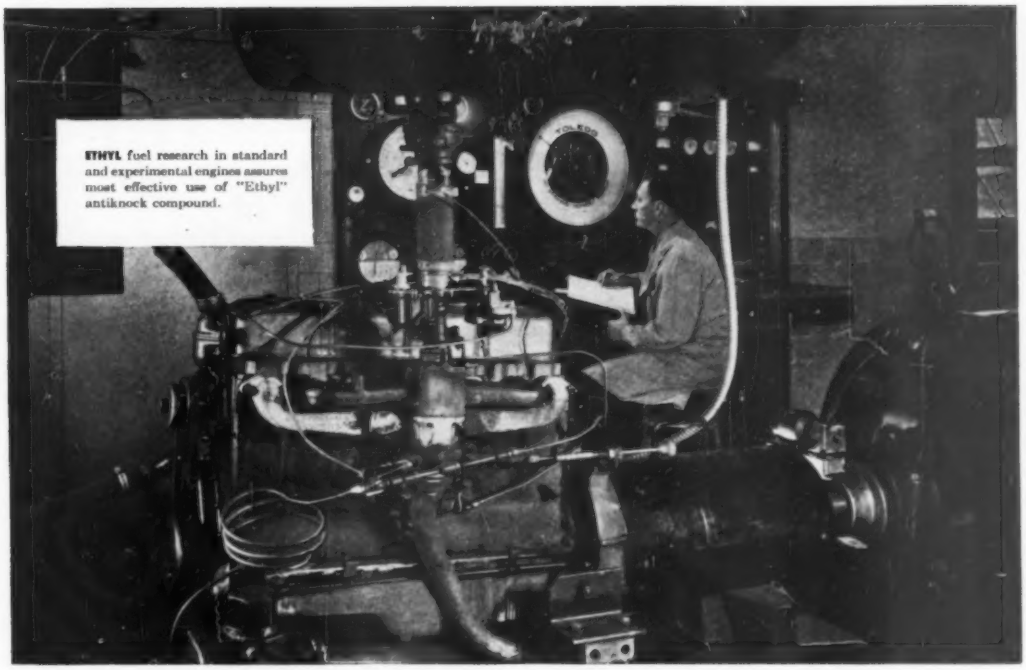

ETHYL fuel research in standard and experimental engines assures most effective use of "Ethyl" antiknock compound.

Ethyl gives refiners' point of view to automotive industry

AUTOMOTIVE ENGINEERS need the latest technical information on fuels and fuel trends for guidance in the design of improved engines for tomorrow's vehicles.

The source of this technical information is the hundreds of individual companies that make up the petroleum industry. The Ethyl Research Laboratories, closely associated with the technical and refining departments of the oil companies, continuously collect and integrate information on fuels and petroleum refining. Much of this valuable information comes from over 225 oil companies, which improve their gasoline with "Ethyl" brand of antiknock compound.

A continuous program of study enables Ethyl's research staff to interpret fuel trends in terms of possible future engines. Because of the strategic location of Ethyl's modern laboratories in the center of the automotive industry, this store of technical information is available immediately for the benefit of automotive engineers.

Today the refiner is producing a larger number of components for blending base gasolines. These stocks represent many classes of hydrocarbons having a variety of molecular structures that cover a wide range of antiknock performance.

Because of the importance of analyzing and interpreting refining developments to automotive engineers, Ethyl Research Laboratories maintain close contact with both industries and cooperate in research programs having common interest. This kind of teamwork does much to assure that engines are designed to make the best use of the product provided by the oil companies.

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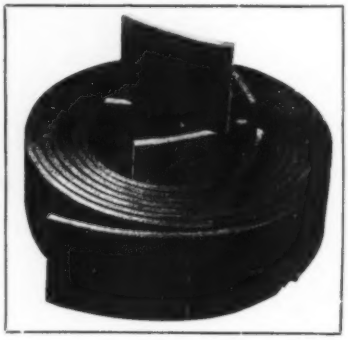

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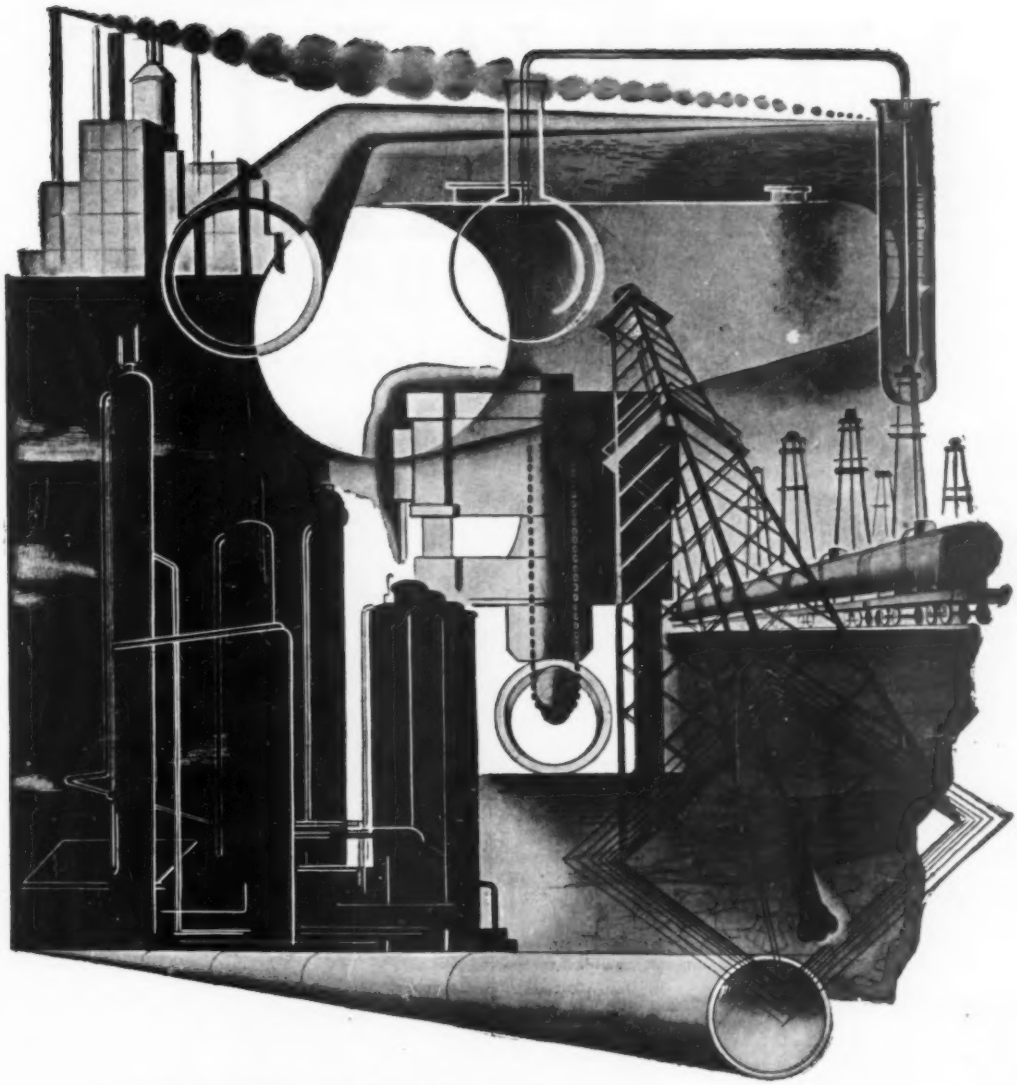

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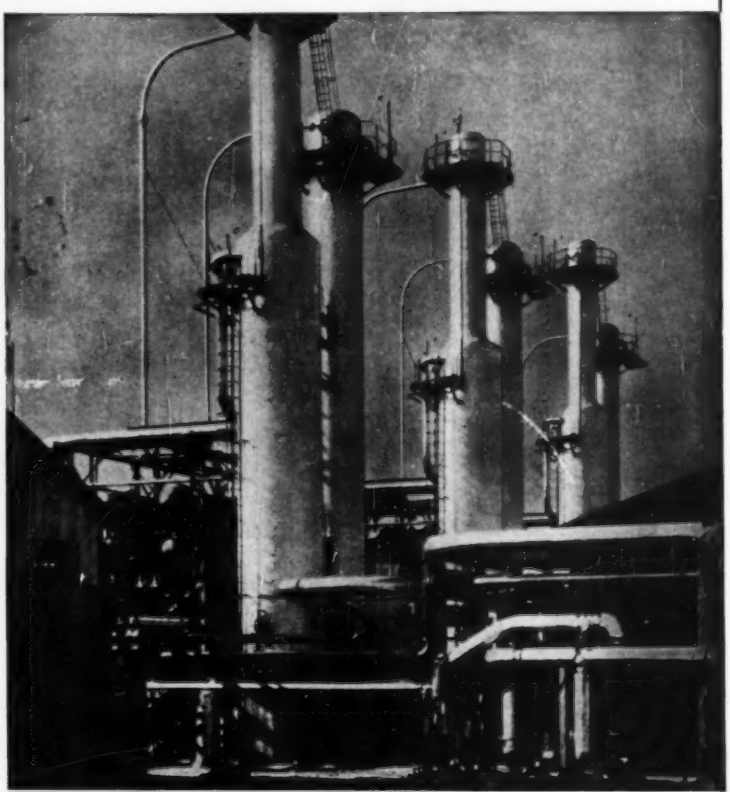

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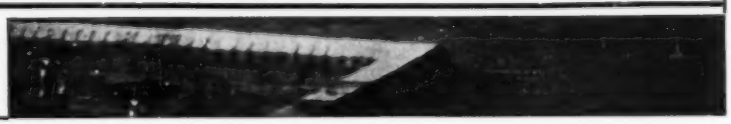

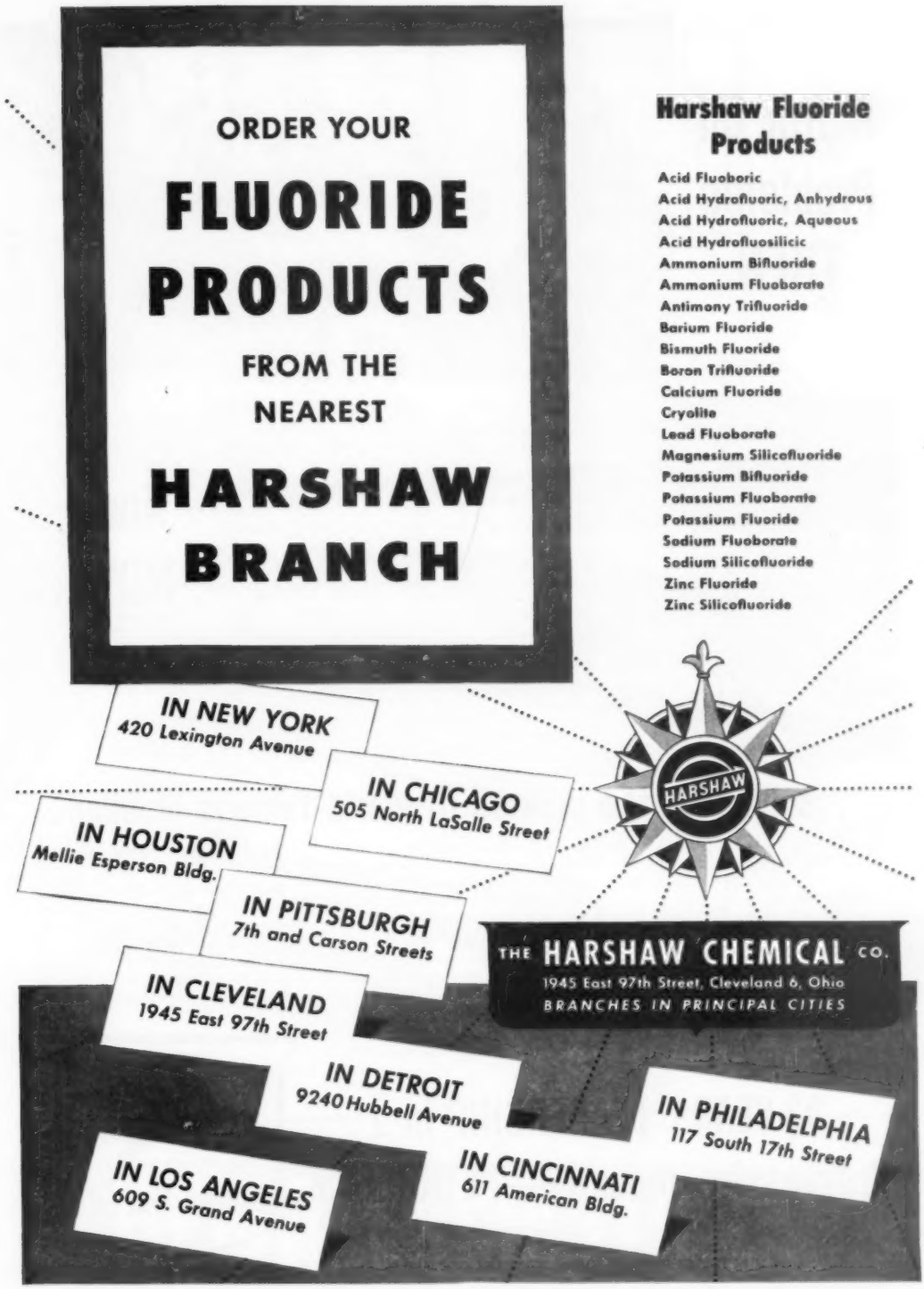
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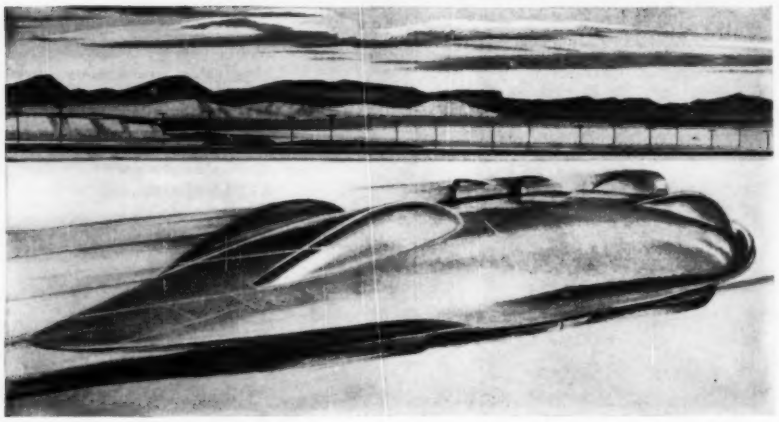
Motor Oil Problems THEN...



And NOW!...

...solved by the makers of world-famous Mobiloil!

SEEMS a far cry—from faltering old 15-mile-an-hour "gas buggy" to John Cobb's sleek, 403-mile-an-hour "Railton Special"....

Yet, strangely enough, *both* were faced with many of the same problems—of engine heat, speed and pressure... *both* got help from Socony Vacuum Correct Lubrication.

From the very birth of the automobile, Socony-Vacuum has worked with automotive engineers—helped find the answers to exacting problems with new developments from petroleum. With each new advance in engine design and engineering, we've been ready with the exactly right lubricating oil for the job!

Today, we think it highly significant—that John Cobb—with a $100,000 investment to protect—chose Mobiloil to help set a new world's landspeed record—*the very same Mobiloil your Mobilgas dealer puts in your car's crankcase!*

And that's just *one* vote of confidence in Socony-Vacuum leadership in petroleum!

Today, Socony-Vacuum products are used by one-third of the world's merchant ships, hundreds of U. S. railroads, millions of cars, thousands of planes, hundreds of thousands of homes and in manufacturing every kind of industrial and consumer goods!

— 83 YEARS' LEADERSHIP in a Progressive Industry—PETROLEUM

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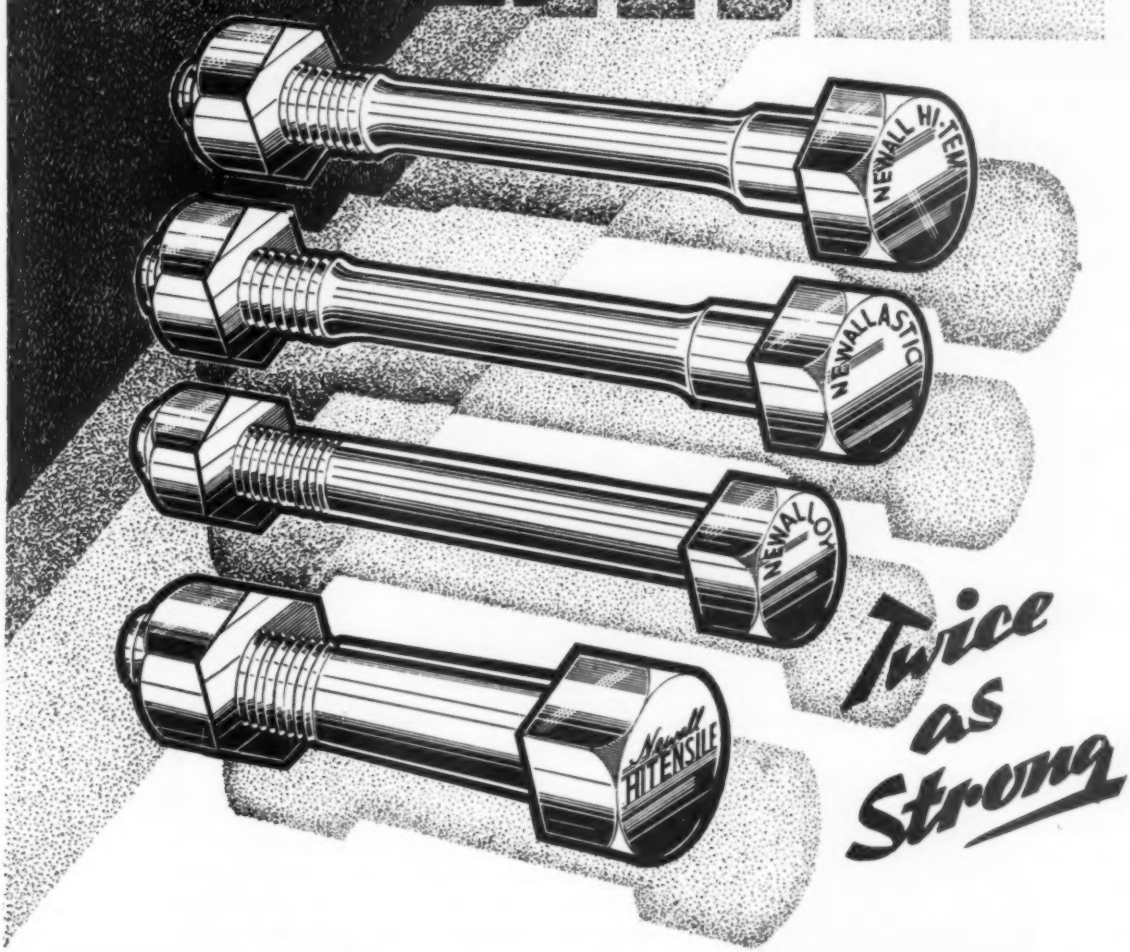

Twice as Strong

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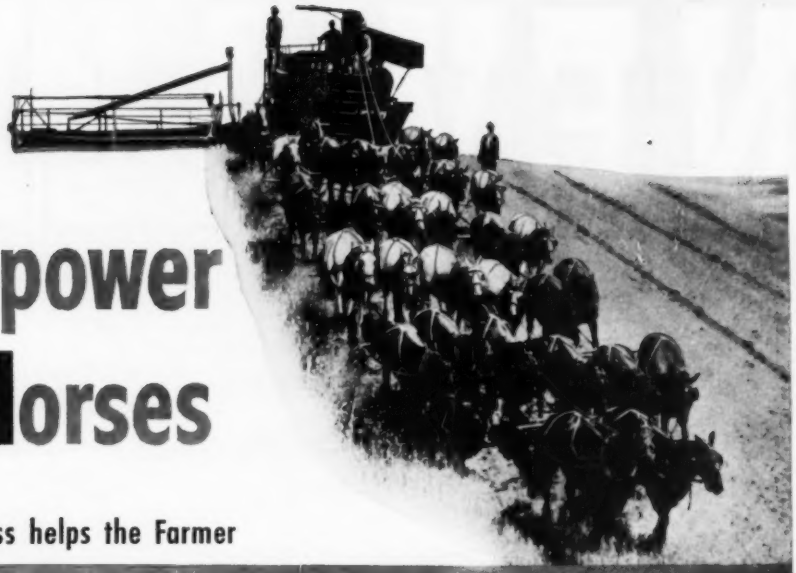


Horsepower without Horses

Petroleum Progress helps the Farmer

DOBBIN yields to the tractor to increase farm food production. Last year America's farmers used over 3 billion gallons of tractor fuel alone, not counting fuels for trucks and other equipment.

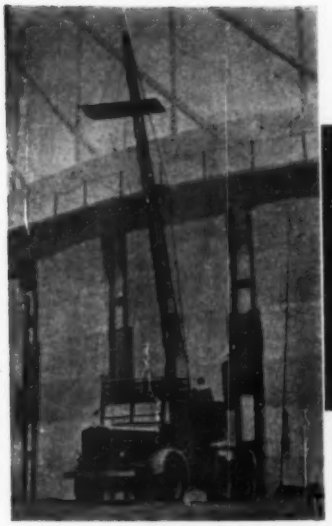
Many farm products are used *by* the petroleum industry . . . 20 million pounds of beef tallow annually for steam locomotive driving rod and axle grease alone . . . also lumber, fibre, paint materials, leather and other products. A chemical derived from oat hulls and corn cobs is extensively used in a Texaco method of refining lubricating oils.

Texaco representatives in all 48 states help farmers with their lubrication problems.

• In the farm field Texaco research and engineering have provided, (1) quality fuels and lubricants for automotive equipment, (2) quality lubricants for farm machinery, (3) rustproof compounds to protect against deterioration of equipment, (4) a nation-wide educational program to enable farmers to get the most out of farm machinery in every type of farming.

THE TEXAS COMPANY

Petroleum Promotes Progress



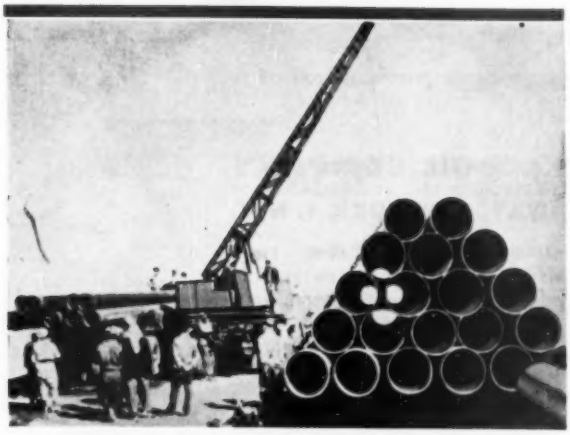
Erecting Petrol Storage Tank in Iraq.

Handling General Stores

Oil Pipe Lines being lifted into position.

A STEEL ASSOCIATED INDUSTRY

COLES



Laying Oil Pipe Lines from the Arabian Oilfields to Haifa Refineries.

are used by principal Oil Companies throughout the world for laying pipe lines, erecting derrick head gear, erecting petrol storage tanks, and handling all types of stores and equipment.

COLES CRANES incorporate full circle slewing, and standard models with either petrol-electric or diesel-electric drive are available to lift from 1 to 12½ tons.

COLES CRANES are produced as self-propelled units or alternatively mounted on approved lorry chassis.

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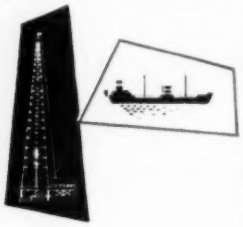
NEW ZEALAND . . . Its rich soil, moderate climate and man's diligent labor have combined to produce bountiful crops, sturdy sheep and cattle, and have made this country one of the world's largest exporters of wool, mutton, beef and dairy products. Mineral deposits and timberlands add to the country's natural wealth; its growing enterprises include textiles and clothing, electrical equipment and household appliances, footwear, food canning, motor car assembling, furniture, plastics. As these and other industries expand, the self-reliant people of New Zealand move ever forward toward a better standard of living for all.

Standard-Vacuum is proud of the part its affiliates play in supplying the petroleum products so essential to the welfare and continued growth of New Zealand.



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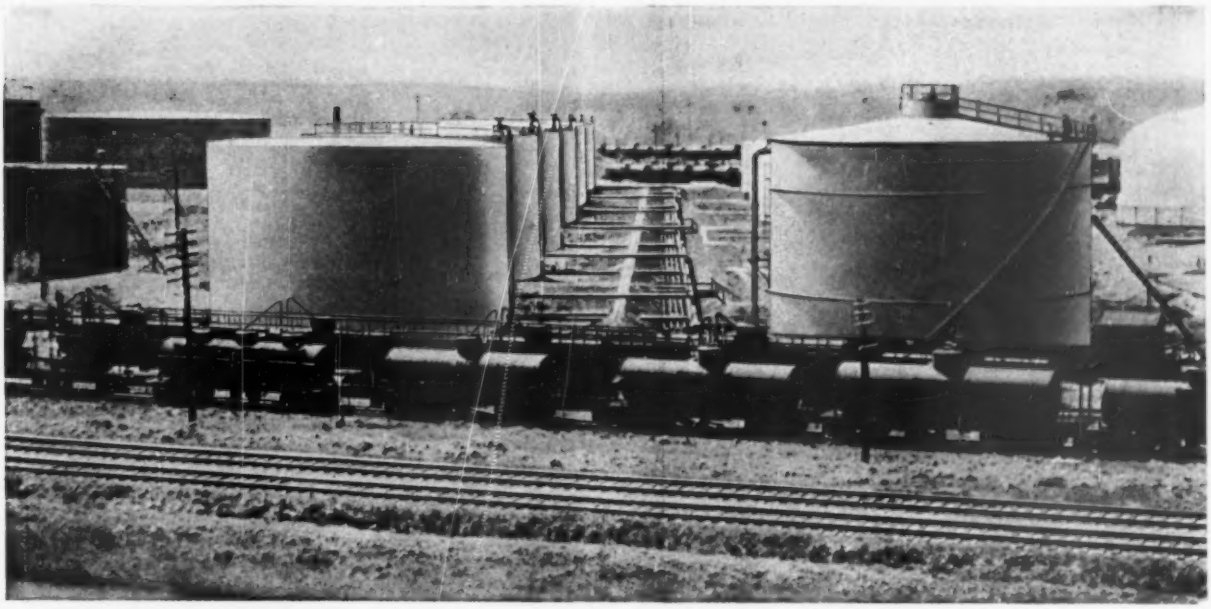

EVAPORATION THE ENEMY OF CONSERVATION

The Wiggins Dry Seal Gasholder shown above at the right, interconnected to six storage tanks is enabling a prominent oil company to turn vapor losses into profits. Today — more than ever before — this is both a patriotic and economic necessity.

A new booklet "Wiggins Vapor Balancing Systems" is now available. It describes and illustrates many exclusive Wiggins design and construction features of both the Wiggins Lifter Roof and the Wiggins Dry Seal Gasholder.

WIGGINS CONSERVATION STRUCTURES

- Hidek Floating Roofs
- Lodek Floating Roofs
- Balloon Roofs
- Breather Roofs
- Dry Seal Lifter Roofs
- Dry Seal Gasholders

Charts of various types of evaporation losses, a graph and "Pay-Out Analysis" table should prove valuable to every executive and engineer responsible for the efficient storage of products subject to evaporation losses. Write for a personal copy today.

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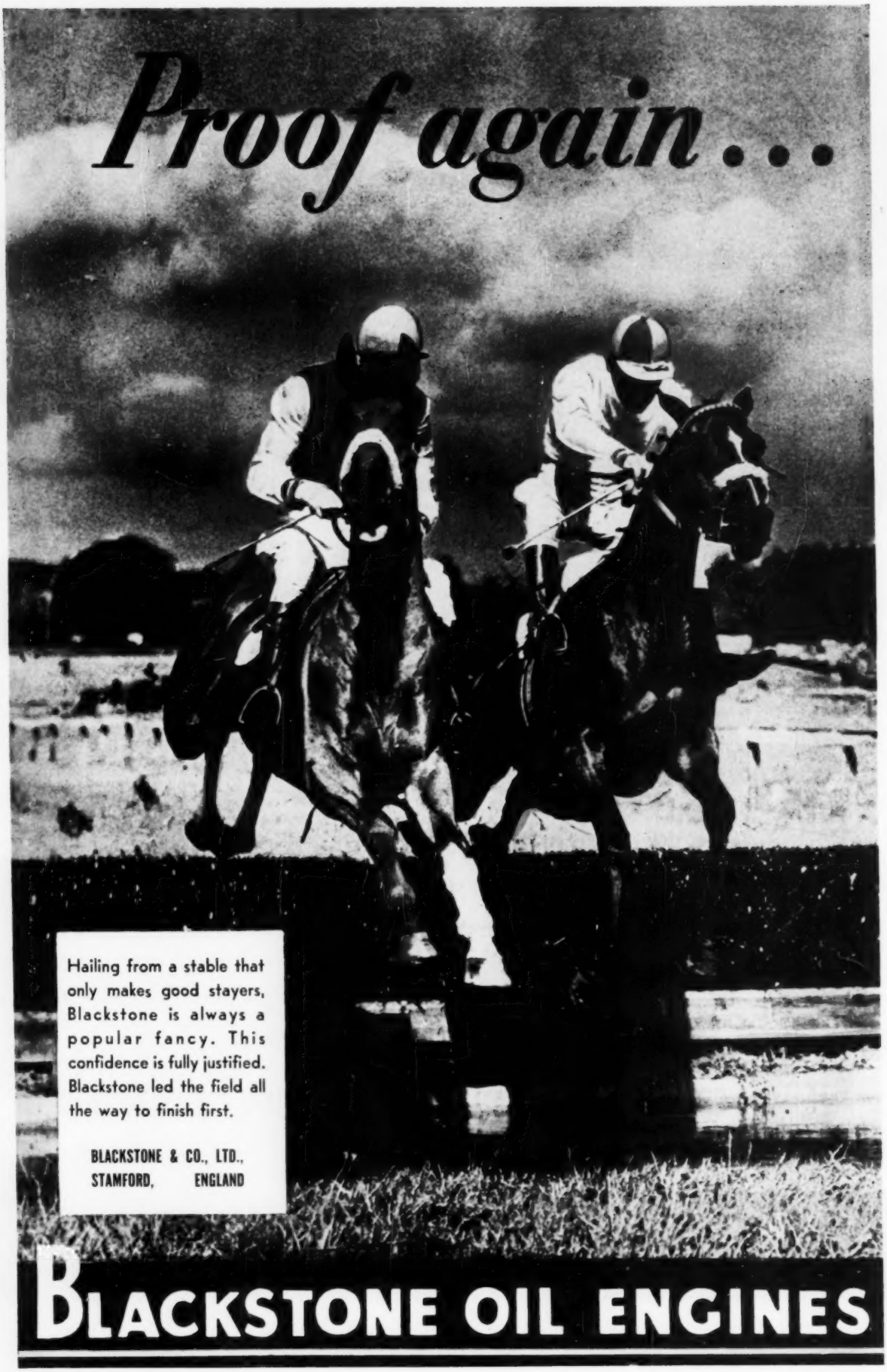
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Hailing from a stable that only makes good stayers, Blackstone is always a popular fancy. This confidence is fully justified. Blackstone led the field all the way to finish first.
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TIDE WATER ASSOCIATED OIL COMPANY

70 YEARS SERVING THE PUBLIC

1878 1948

THE PETROLEUM INDUSTRY IS A PROGRESSIVE INDUSTRY
DEDICATED TO SERVE MANKIND FAITHFULLY AND WELL

The World's Most Famous Motor Oil

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MOTOR OIL

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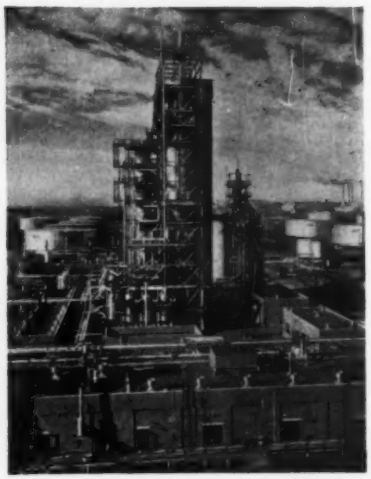
NUMBER 7 IN A SERIES

The important question in foreign refinery construction is "Which Master Contractor?"



GREAT pressure for refinery expansion and refinery modernization is now being felt in foreign fields, where both a ten year hiatus in building and major war destruction must be overcome. The new capacity required is large and presents serious capital outlay problems to both foreign national refiners and foreign subsidiaries of American companies.

The *master* contract type of operation, concentrating all engineering, material procurement and construction responsibility at any one refinery site in one organization's hands, is especially desirable in this work because of the inherent potential for major capital savings which has been established previously in this series.

Thus, the question facing refiners undertaking projects for installation outside the United States becomes not *whether* to use the *master* contract type of operation but, rather, *which* "master" contractor to engage. To clarify consideration of this latter question, Kellogg presents what it believes to be the most important factors which should be taken into account when selecting a *master* contractor for foreign work.

First, it would appear most important to select an engineer-contractor that has had repeated experience with the multitudinous responsibilities of varied types of *master* contract operations and naturally a successful record.

Further, the contractor's *existing* establishment, in manpower and resources, should be capable of handling the entire project both expeditiously and efficiently *within his own organization.*

Second, this contractor should have had experience in *foreign* operations—not necessarily at the particular location of the proposed job, but most assuredly at a sufficient number of foreign locations so that the contractor's organization shall have learned *previously* the many unusual, and in many respects more difficult, requirements of foreign operation.

Third, the contractor's design groups—laboratory, process and mechanical—should have *a secure and unquestioned engineering reputation,* eliminating any desire or need to build "monuments to advanced processing" for prestige purposes, when such refinements are not justified by immediate and specific economic need. In short, the contractor's engineers should be mentally conditioned to approach the planning of each project on one basis only—*to design facilities which will meet the immediate and foreseeable market demands and in so doing earn the most pesos, cruzeiros, dinars, pounds, or francs over a period of years for the least immediate capital outlay.*

Fourth, under present world supply conditions, the contractor's ability to perform effectively the complex and difficult *task of procurement* of materials and equipment will prove critical in accelerating the on-stream date of the plant. Maximum speed and final economy in the conduct of this responsibility requires three basic capabilities: An existing procurement group *large* enough and *experienced* enough to purchase, inspect and expedite with thoroughness and dispatch the thousands of items of material and equipment which comprise a major refinery project; an *up-to-the-minute detailed knowledge of world-wide sources of supply,* which can be maintained only through active purchasing activity carried on constantly over the years in the major markets of the world; together with the "know-how" to utilize local currencies to the utmost in the procurement phase.

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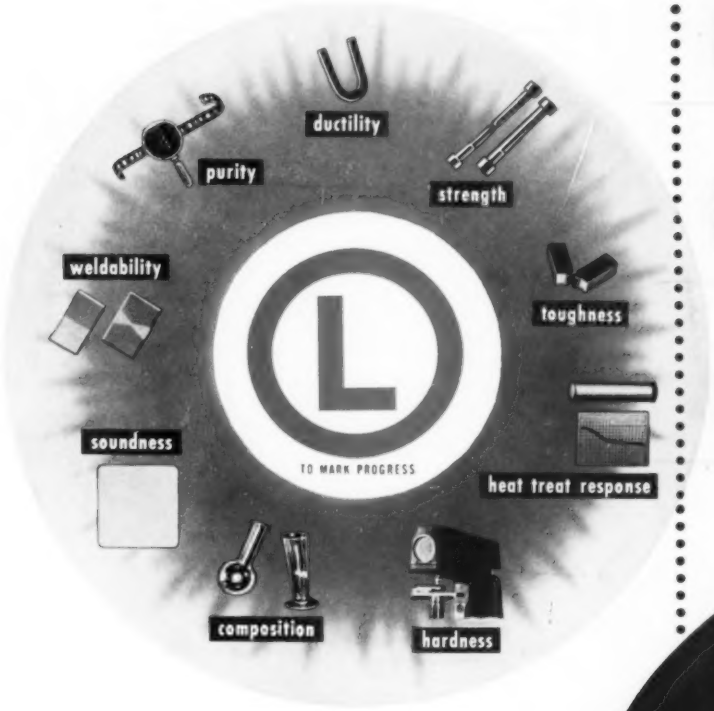

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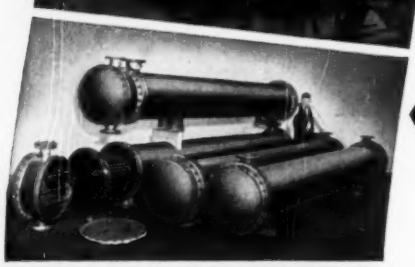

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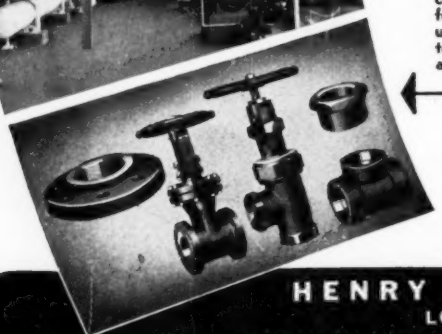

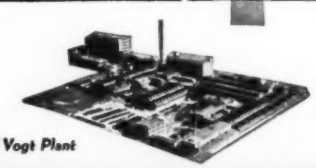

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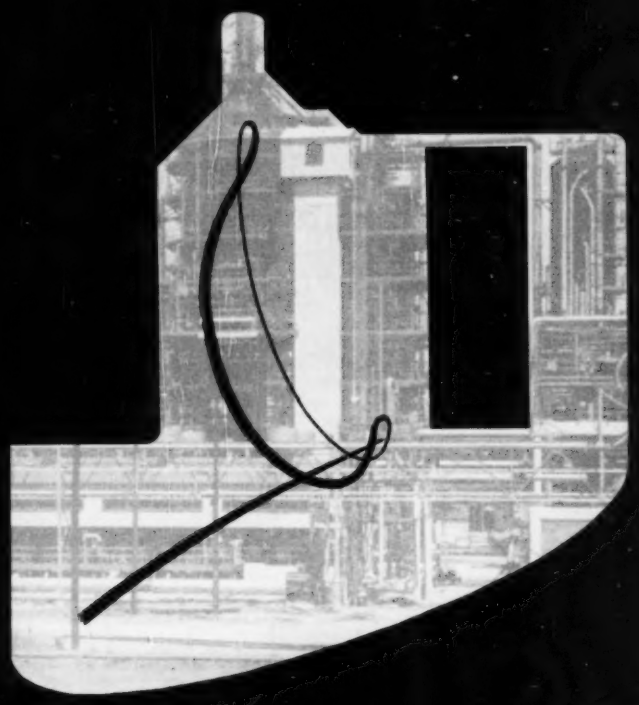
process rhythm



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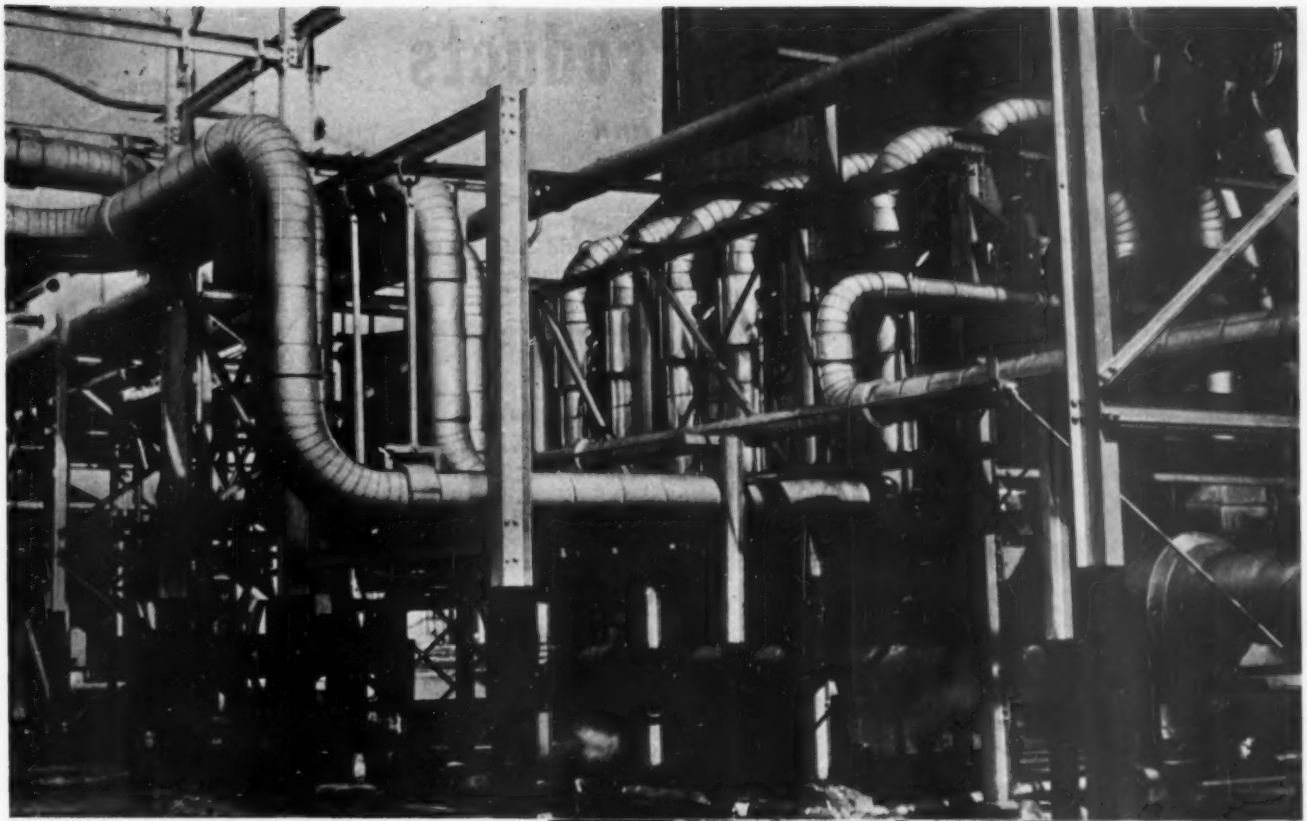

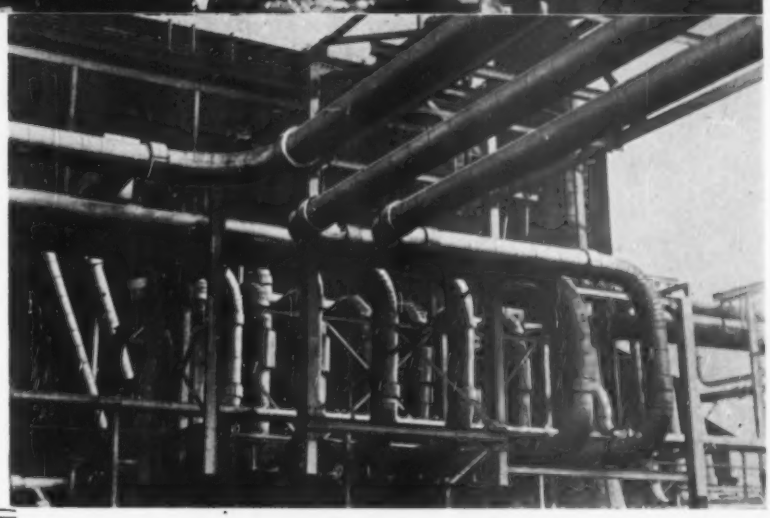

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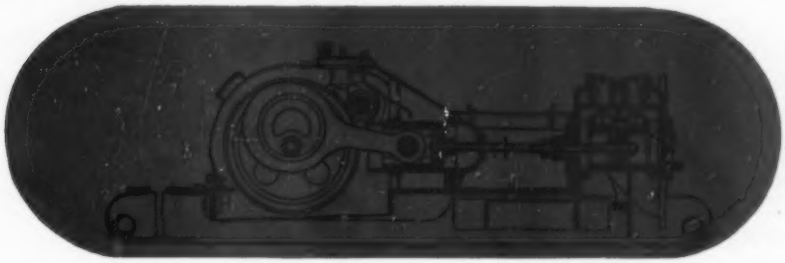

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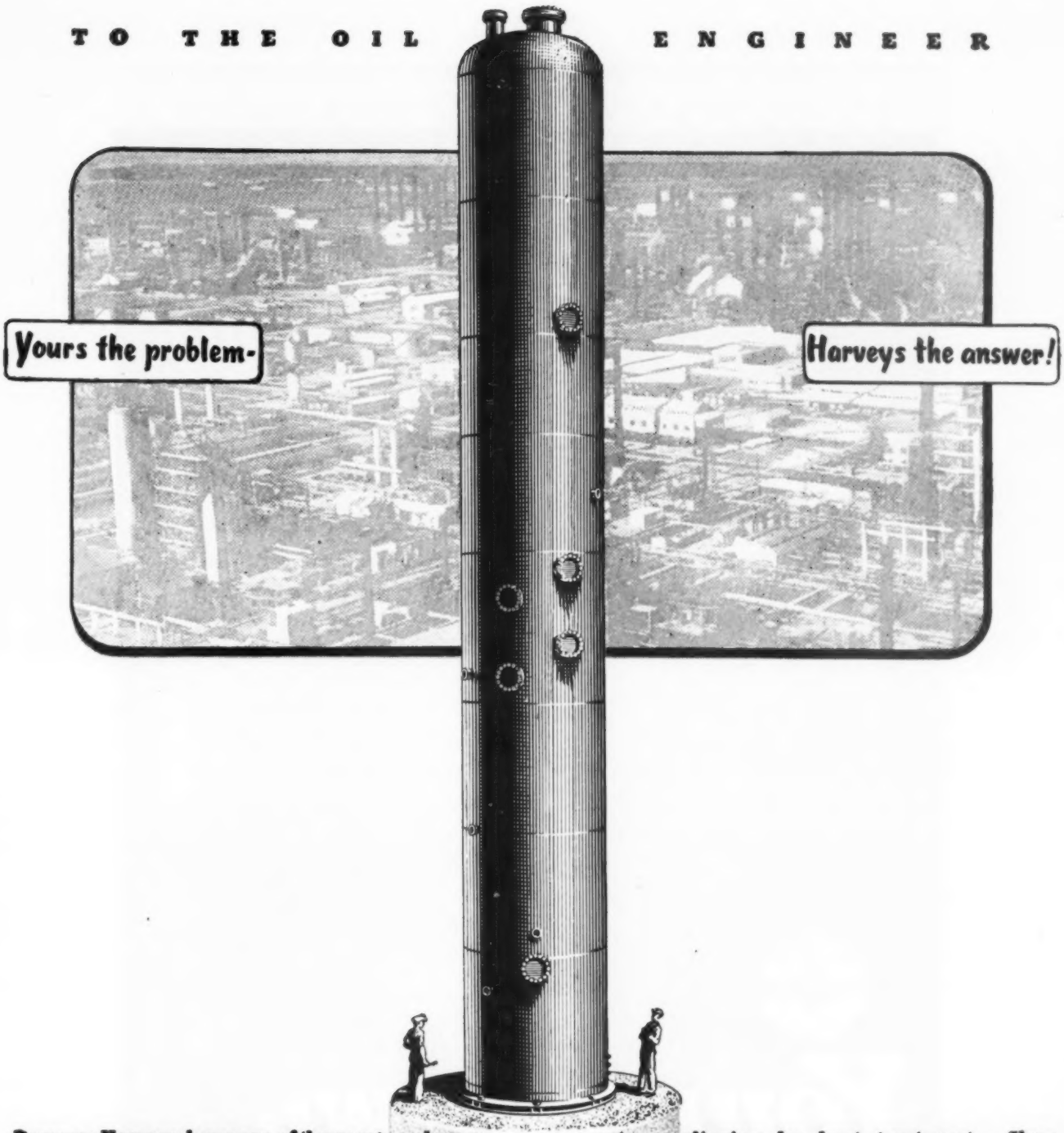

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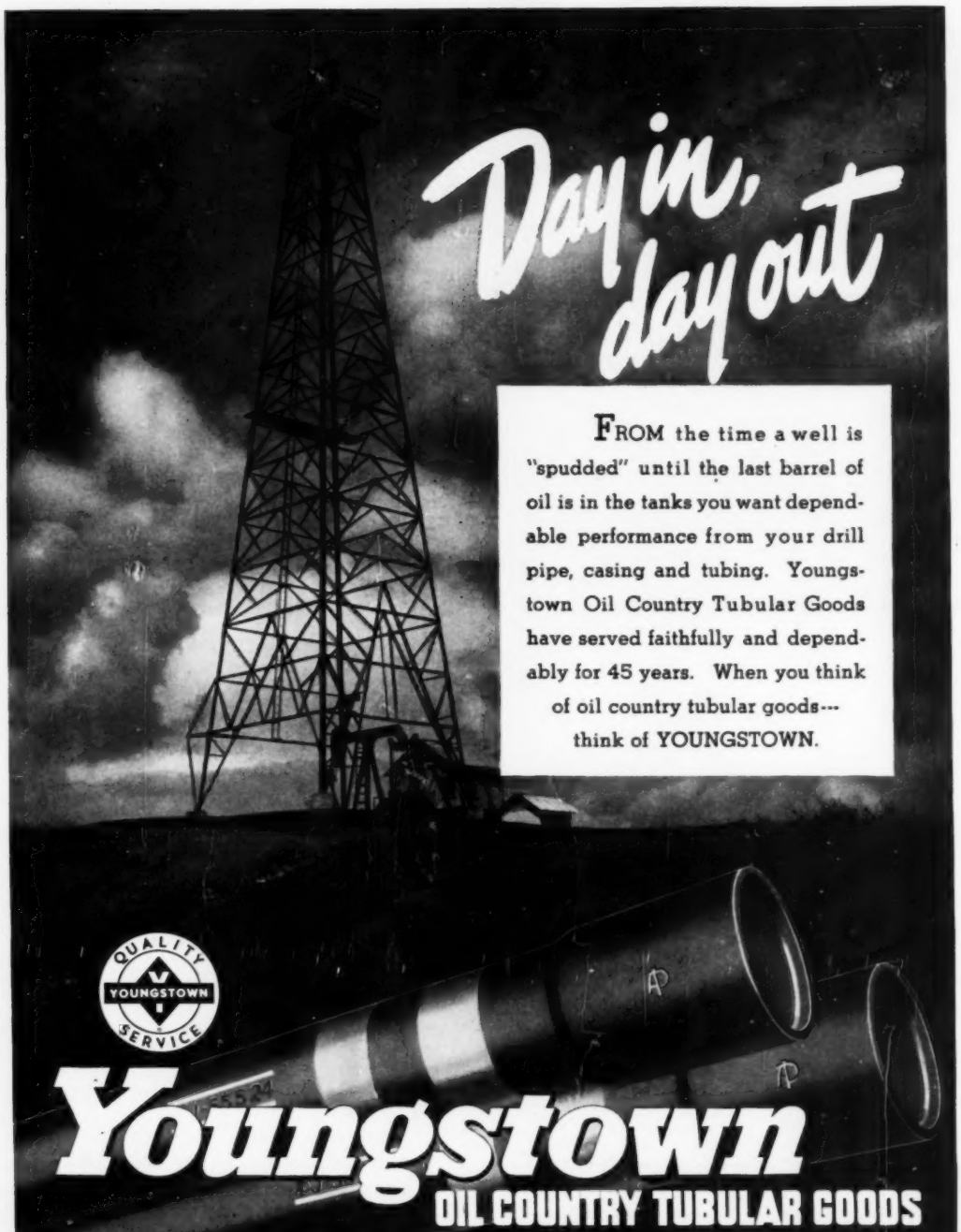
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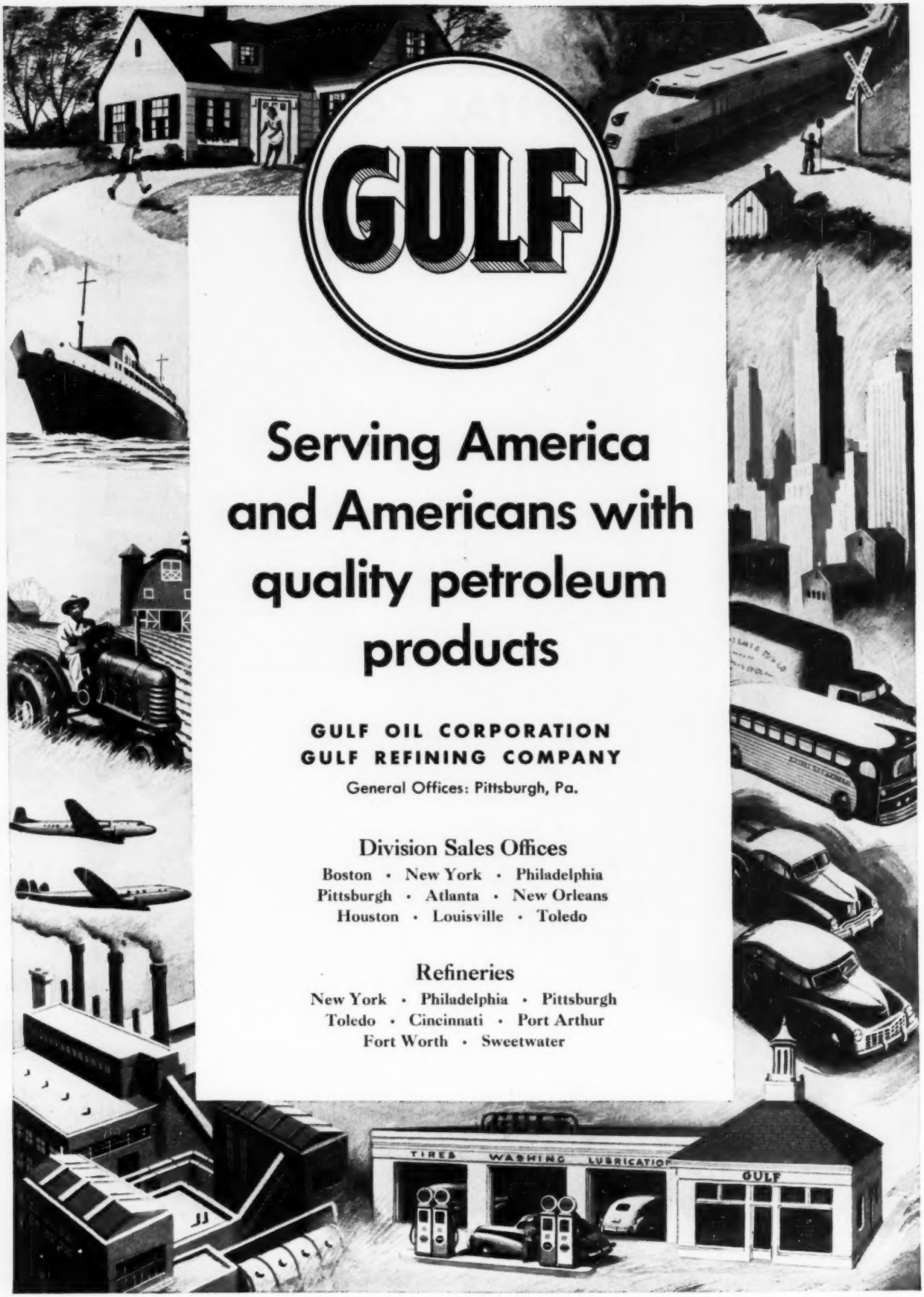
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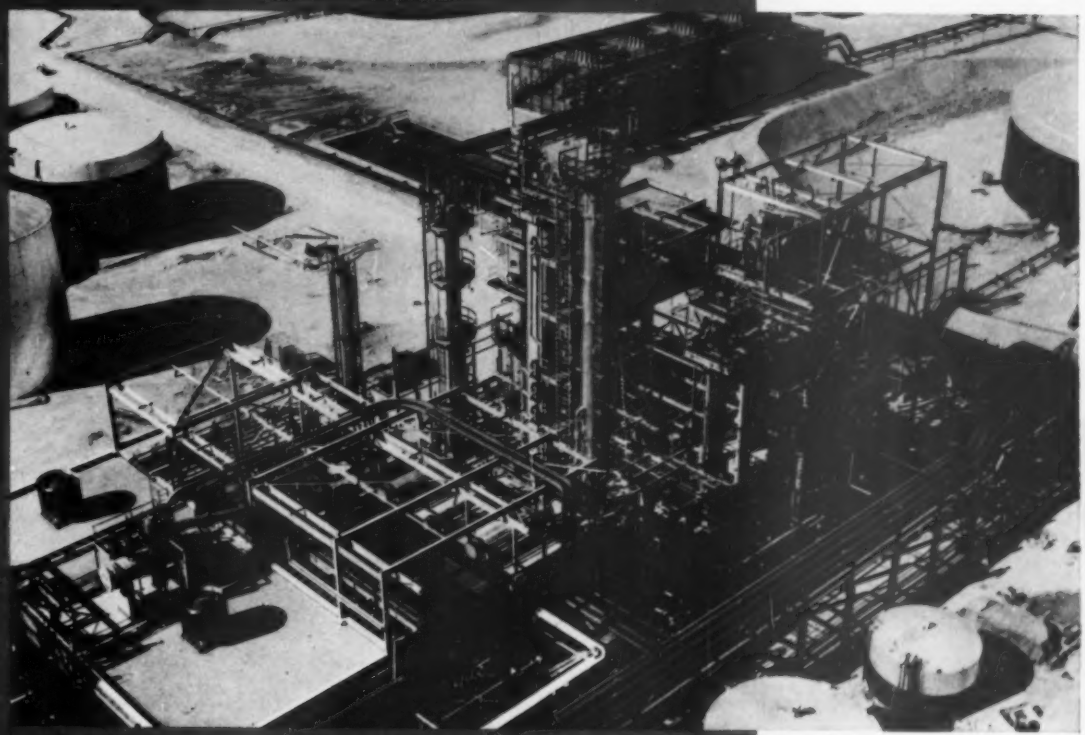

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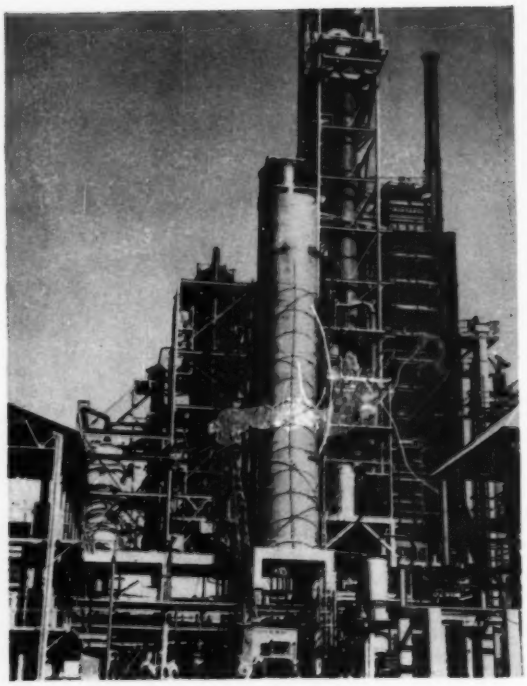

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Founded by Russell Palmer

PUBLISHED BY MONA PALMER

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THIS MONTH'S COVER—Deckhands aboard the tanker Esso Manhattan knocking ice from the fore deck catwalk. Photo by Parks for Standard Oil Co. (N.J.)

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EDITORIAL

THE MYTH OF OIL INDUSTRY PROFITS

WHILE a joint Congressional committee has been conducting public hearings during the past month on the question of whether the profits of industry are excessive, there is no reason for such debate in the opinion of some of the men who will occupy influential positions in the new regime that assumes legislative control of the federal government this month. For example, Senator O'Mahoney, who is expected to become chairman of an important Senate committee, has bluntly warned business that it must pay more in taxes or submit to more drastic regulation. There has been a revival of the fallacious claim that wages can be raised indefinitely without advancing the cost of manufactured products by the simple device of paying the increase out of profits.

In this medley of discussion the oil industry seems to have been singled out for special attack. Critics have declaimed loudly against its unprecedented earnings and the rise in price of its products, although the increase in the latter has been much smaller than in the case of many other less essential commodities. To a large extent the reported earnings are illusory, since oil companies have been disposing of resources acquired far below present replacement costs, and these original costs, in accordance with conventional accounting practice, have been subjected to depletion and depreciation charges totally inadequate to provide the new production and the modern facilities necessary to supply the swiftly expanding demand.

Living costs have risen for the petroleum industry in greater proportion than for most others. On a dollar basis the investment required to produce or to refine a barrel of oil has multiplied fourfold in the past decade. This is due not merely to the rise in the price of materials and equipment but is complicated by the fact that the finding of productive wells has become more difficult and involves deeper drilling. In the processing of crude, the up-to-date plant demands more complicated and expensive equipment to provide the wider range and higher quality of products demanded today.

A recent study conducted by a large company presented in detail some of the expenditures required of the oil industry by the expanding use of its products. This analysis showed that for each new passenger car put on the road a capital investment of $530 is necessary to provide it with gasoline and other product needs. Every commercial vehicle requires $970. A 2,000-horsepower diesel locomotive replacing a coal burner adds $108,000 to the oil industry's outlay, while $221,000 of oil company expenditure is necessary to maintain the average commercial airplane. To supply fuel for an additional oil heating installation means that $670 must be laid out. Translated into these terms, it is easy to understand that bringing into service motor vehicles and heating units by the million makes it necessary to invest billions of dollars yearly in the enlargement of production and plant facilities.

Unfortunately the oil industry does not have the alternative available to individuals and companies in some other lines of business of postponing capital expenditures in the hope that declining prices may lower their costs. The consumers of petroleum products demand that their requirements be met as they arise. They will not accept excuses as a substitute for performance. Unfortunately, too, the unfavorable investment climate that now prevails has precluded the former recourse of capitalizing long-term investment from the sale of securities. As a consequence the essential growth of the industry has had to be financed mainly out of earnings. Had it not been released from the restrictions which held it to an uneconomic basis and permitted to operate more nearly in accordance with the law of supply and demand, it would not have been possible for the industry to meet the continuing rise in consumption and to remove the possibility of shortage which caused so much concern in official circles during 1947 and the early months of 1948.

Some illuminating figures on the extent and disposition of oil industry earnings were placed before the Congressional committee last month by Joseph E. Pogue, leading oil economist, who has conducted a continuing study of thirty representative companies for the past several years. Mr. Pogue showed that during the year 1947 these companies generated $2,160,000,000 out of operations and obtained only $743,000,000 of outside funds. Out of this total $2,076,000,000 or 71 percent went into capital expenditures, $175,000,000 to working capital, $197,000,000 to debt retirement and refunding and $455,000,000 to shareholders and minority interests. With adjustment for income taxes and the changed value of the dollar, the amount accruing to shareholders was $208,000,000 or approximately one-tenth of the amount of capital expenditures and was less in proportion to total receipts than was received ten years before in 1937. In other words, this segment of the industry spent 90 percent of its available funds in improving its ability to serve the public.

"PROFITS" IN THE PETROLEUM INDUSTRY

By Joseph E. Pogue

Dr. Joseph E. Pogue, vice president of the Chase National Bank, in charge of its petroleum department, appeared Dec. 9 before the Subcommittee on Business Profits of the Joint Committee on the Economic Report of the Congress. The following is an abbreviated report of the statement he made to the committee in his private capacity as a petroleum economist. It is reproduced here because of the clarity of its analysis of the profit situation in the oil industry which is most important today because of the possible consideration by Congress of an excess profits tax.—Editor.

FEW business terms are less understood than "profits." The expression is often thought of as representing the funds left over after providing for all expenses and available in their entirety for removal from the business in the form of dividends. This is rarely true in ordinary times and entirely false in times of inflation.

There are four basic conditions which should be clearly held in mind by anyone seeking to analyze the size and significance of profits. I shall try to define these four principles and then briefly illustrate each point by data taken from our study[1] of 30 oil companies.

1. In times of inflation or rapid change in the purchasing power of the dollar, "profits" as reported on the basis of established accounting practice are in effect overstated by the amount of the rise in replacement costs over the sum set aside to cover capital extinguishments—depreciation, depletion and the like.

2. In times of inflation, reported "profits" cannot properly be compared with previous years because of the shrinkage in the purchasing power of the dollar. Only by correcting for the changing length of the yardstick can this be done with any semblance of accuracy.

3. In times of inflation the rate of return on the capital employed, ordinarily a very useful standard, cannot be used as a criterion of the magnitude of profits because the rate of return is a ratio between two sets of dollars of different values. It is a mathematical error to strike a ratio between things of a different kind. Only by adjusting either the capital employed or else the "profits" to like dollars is such a ratio permissive.

4. In all times, inflationary or normal, the most effective criterion to apply in the judgment of "profits" is their adequacy or inadequacy in the process of capital formation. Our entire economy is dependent upon the formation of sufficient capital funds to maintain and expand the country's productive capacity. As capital costs rise, "profits" are called upon to supply increasing amount of these funds.

The reported net income of 30 oil companies was $763 million in 1946 and $1,219 million in 1947, an increase of $456 million or 60 percent. On the face of it, this increase appears large. But the charges for capital extinguishments (depreciation, depletion, etc.), designed to recover the capital funds extinguished during the year were inadequate to replace the physical counterpart of this capital at prevailing higher costs. "Profits" were, therefore, called upon to make up the discrepancy, and part of the reported total was diverted to this purpose. Thus "profits" computed by accounting procedure were larger than de facto profits. In other words, the increased cost of replacement appeared on the books as a profit.

The extent to which reported "profits" were thus in effect overstated can be approximately determined by adjusting the capital extinguishment charges, which are expressed in historical dollars, to that they reflect current dollars or the cost of the physical capital to be replaced. If this is done[1], we find that the adjusted net income[2] becomes $418 million in 1946 and $513 million in 1947, an increase of 23 percent. These figures are, respectively, $382 million less and $763 million less than the reported figures which are accordingly magnified by inflation to the extent of 91 percent in 1946 and 149 percent in 1947. It thus becomes apparent that the changing value of the dollar distorts the income account so that the reported net income ceases to be synonymous with profit.

The absorption of part of the reported net income by the higher costs of replacements is indicated by a 1947 rise in capital expenditures of $699 million and by a decline in the percentage of net income paid to stockholders from 43.4 percent in 1946 to 34.9 percent in 1947. By way of comparison, this ratio was 66.3 percent in 1938.

All financial transactions are ordinarily expressed in monetary units. The dollar, of course, is our standard of value just as the yard is one of our standards of length. "Profits" are expressed in dollars. But these dollars are no longer the same from year to year; their purchasing power or value was changed. Thus it is not proper to say that the "profits" of 30 oil companies have increased from $763 million in 1946 to $1,219 million 1947. One can say with propriety, however, that these "profits" increased from 763 million 1946 dollars in 1946 to 1,219 million 1947 dollars in 1947. This consideration suggests that a more correct view of the change in "profits" can be gained if the dollars are adjusted to reflect the same purchasing power.

This adjustment can be made with a fair approach to accuracy by dividing the reported dollars by the Bureau of Labor Statistics Index of Wholesale Prices of All Commodities. If this is done, the adjusted net income, expressed in dollars of prewar purchasing power, becomes $590 million in 1946 and $648 million in 1947, the latter figure showing an increase of $139 million, or 27 percent, from 1946. Thus it is found that 33 percent of the reported "profits" for 1946 and 47 percent of the reported "profits" for 1947 were absorbed by the shrinkage in the value of the dollar.

If this correction is not made in the reported figures, one finds himself comparing two different kinds of aggregates and falling into the same type of error as if he concluded that two bushels are twice as much as one ton.

The rate of return on capital employed is ordinarily a useful and widely-used measure of profits. It provides a true picture so long as the value of the dollar remains reasonably constant. It is computed by establishing the ratio of current net income to accumulated borrowed and invested capital, or invested capital alone. Since investments are made in the past and income is derived in the present, this ratio is obviously the relation of present dollars to past dollars. If the two sets of dollars are approximately the same value, all well and good. But if the two sets of dollars differ substantially, as they do when inflation intervenes, then the ratio is not only false, but one commits a mathematical error even in computing it.

For the 30 oil companies in 1946 and 1947, the rate of return on borrowed and invested capital indicated by the reported figures rose from 9.3 percent to 13.2 percent. But this computation is erroneous. The error, however, can be eliminated if the numerator and denominator of the ratio are expressed in like dollars. When this is done, the adjusted rate of return becomes 6.5 percent for 1946 and 7.7 percent for 1947.

Capital is a word with two meanings. It represents monetary funds which are held or expended, and it represents plants and facilities for which the expenditures are made. We shall refer to financial capital as "capital funds" and to physical capital as "plant and facilities."

Capital originates out of savings—production in excess of consumption. There is no other source. Savings may be made by productive units, such as corporations, and by individuals; and through the intervention of credit, future savings can be transferred to the present.

Capital formation is the process whereby capital funds are accumulated and converted into physical capital. Economic progress depends largely upon the rate of capital formation, and, therefore, the process is indispensable to our standard

[1] "Financial Analysis of 30 Oil Companies, 1947" by Joseph E. Pogue and Frederick G. Coqueron.

[1] All adjustments presented in this statement are computed by means of well-known economic indices and expressed in terms of 1935-1939 = 100 as a prewar base. The indices and computations are shown in detail in "Financial Analysis of Thirty Oil Companies for 1947," previously referred to.

[2] These computations were made on the basis of net income before deducting minority interests' share.

of living. Measures which interfere with capital formation are harmful.

Let us examine the bearing of oil company "profits" upon capital formation in the petroleum industry. We shall use the record of 30 oil companies for the illustrative figures.

In 1947 this group of oil companies generated cash out of its own operations to the extent of $2,160 million. This sum was segregated by conventional accounting procedure into $1,219 million of net income and $941 million of depreciation, depletion, etc. The latter item represents an estimate of the capital worn out and used up during the year but was inadequate to replace this capital because costs had gone up. In addition, the group obtained $743 million of outside funds, as follows: long-term debt issued, $476 million; sales of common and preferred stock, $206 million; and sales of assets, etc., $61 million. Thus the group in 1947 generated and obtained $2,903 million of funds.

What became of these funds? By far the larger part, $2,076 million or 71 percent went into capital expenditures. Therefore, this amount represented physical capital formed. The remainder of the funds was disposed of as follows: $175 million to working capital[1]; $197 million to the retirement and refunding of debt; and $455 million to stockholders and minority interests.

This analysis of the source and disposition of funds reveals the anatomy of capital formation in the petroleum industry. And the figures are all expressed in dollars of like vintage—1947 dollars—with one exception. The item of capital extinguishments is estimated on the basis of past dollars, and, therefore, part of the net income dollars must be allocated to this item when it becomes converted into physical replacement of the capital worn out and used up.

Some additional relationships are striking. The $2,076 million of capital expenditures match closely the $2,160 million of cash internally generated; and the same is true of the $455 million of payments to stockholders and minority interests and the $476 million of money borrowed. Does this mean that the group had to borrow the money to pay dividends? The accountant would certainly not admit this, for dividends can only be paid from surplus, but capital expenditures can be made from borrowed funds. But it is certain that without borrowings there would have been hardly any funds for dividends, if capital expenditures had remained unchanged. And if capital expenditures had been less, the oil "shortage" would have been prolonged.

In view of these circumstances, it can scarcely be claimed that the earnings of the oil industry were "too great." The earnings played an essential role in the process of capital formation. Nor was too much capital formed in 1947. It can be stated with assurance that it was the magnitude of capital formation in 1947 and again in 1948 which has converted the petroleum situation from one of scarcity into one of abundance. What could be more important?

It may be observed in passing that the amount of capital expenditures was vastly inflated by the

Dr. Joseph E. Pogue

rise of construction costs. We have computed that 60 percent or $1,236 million out of total 1947 capital expenditures of $2,076 million was occasioned by the rise in costs, a penalty imposed by inflation. In prewar dollars, $840 million would have done the same job.

The item of cash dividends to stockholders remains to be examined. Cash dividends for the group of 30 oil companies amounted to $331 million in 1946 and $425 million in 1947, an increase of $94 million or 28 percent. These dividends, however, were in skrinking dollars. Correcting for income taxes and the changing value of the dollar, we find that the adjusted dividends retained were $186 million in 1946 and $208 million in 1947, an increase of 12 percent. The 1947 adjusted figures are less than either the actual or similarly adjusted levels in 1936 and 1937. The dividends, therefore, did not keep pace with the rise in the cost of living.

Several circumstances combine to make the capital needs of the petroleum industry exceptionally heavy, aside from the obvious one of inflated costs. In the first place, the industry is highly technological, which means that the capital investment per unit of output is large—several thousand dollars per daily barrel. In the second place, the petroleum industry is in a stage of vigorous growth requiring large investments for new facilities. Thus the industry must form capital not only for replacement but also for expansion.

The available data for the 30 oil companies does not permit a segregation of capital expenditures into those for replacement and those for expansion. Obviously the former vary less from period to period than do the latter which are more cyclical. The demand for capital funds for expansion has been particularly large during the past two years, for the industry over that period had to meet an expansion in demand of over 15 percent or about 800 thousand b/d.

For the economy as a whole, it has been estimated that about two-thirds of capital formation is for replacement and one-third for expansion. For the oil industry it is probable that the two categories have recently been more nearly equal. The need for capital funds for oil expansion may be expected to decline in the future, since the rate of growth in demand will probably decelerate, bu- by the same token the demands for replacement will increase as the industry becomes larger. On balance, however, the net effect will probably be some drop in the rate of capital formation, in which event "profits" may be expected to adjust themselves to a lower level of requirements.

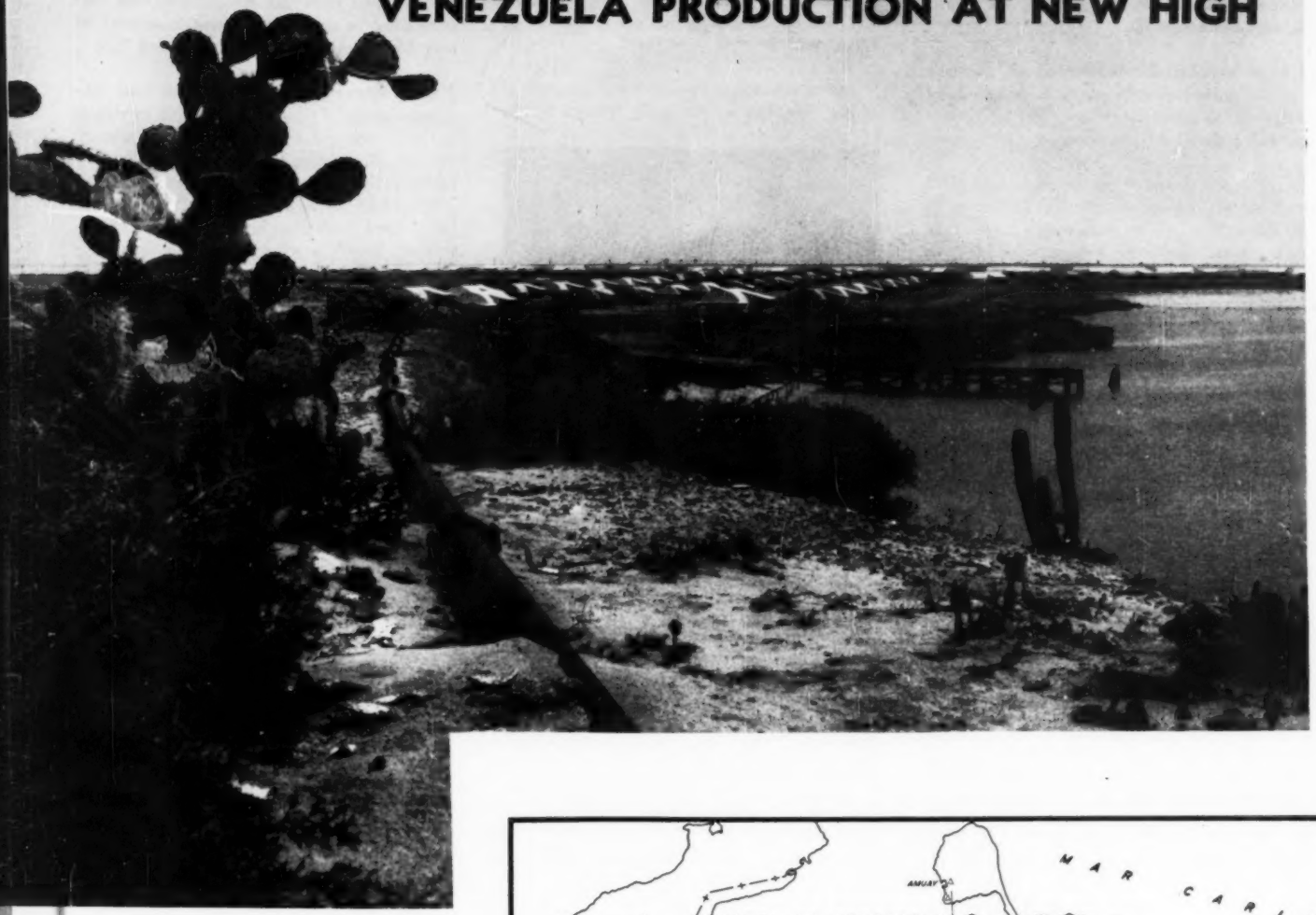
Our analysis has thus bar been confined to 1947 and previous years because adequate data are not yet available for 1948. It is recognized, however, that reported oil "profits" for 1948 will be substantially larger than in 1947. For example, it is estimated that the reported net income for 30 oil companies will amount to $1,410 million for the first nine months of 1948, an increase of $563 million or 67 percent over the corresponding period of 1947. The rate of increase for the full year, however, will be less than for the first three-quarters, because oil company earnings reached their peak in the second quarter of the year.

In keeping with the rise in net income in 1948, which is subject to all the qualifications outlined in this statement, capital expenditures and additions to working capital will also be greater by $600 to $700 million, thus drawing off most of the increment and converting these funds into physical plant, equipment and inventories. The extent to which this process was essential can best be measured by estimating the ratio of cash dividend disbursements to reported net income for the full year 1948. This estimate can be made with considerable accuracy because the dividend record for practically the entire year is now available and only the fourth quarter earnings need be approximated. It thus appears that in 1948 only 24 percent of reported net income will be paid out in the form of cash dividends compared with 35 percent in 1947 and 43 percent in 1946. This drop in the rate of disbursements is pretty conclusive proof that the industry was "strapped" for cash in 1948, despite the magniture of its income, and that earnings the magnitude of its income, and that earnings were further converted into fixed assets.

It is fortunate that this was so. A year ago we faced the prospects of a tight, if not short, oil supply. Today our tanks of oil are full and supply is beginning to run ahead of demand. If this trend continues, the need for capital formation will become less insistent, and the mechanism of the market will reduce profit margins and bring about a lower level of "profits." In this cycle we have an almost perfect example of the function of "profits" in converting an economy of oil scarcity into one approaching abundance.

[1] The additions to working capital also represented capital formation, at least in large part.

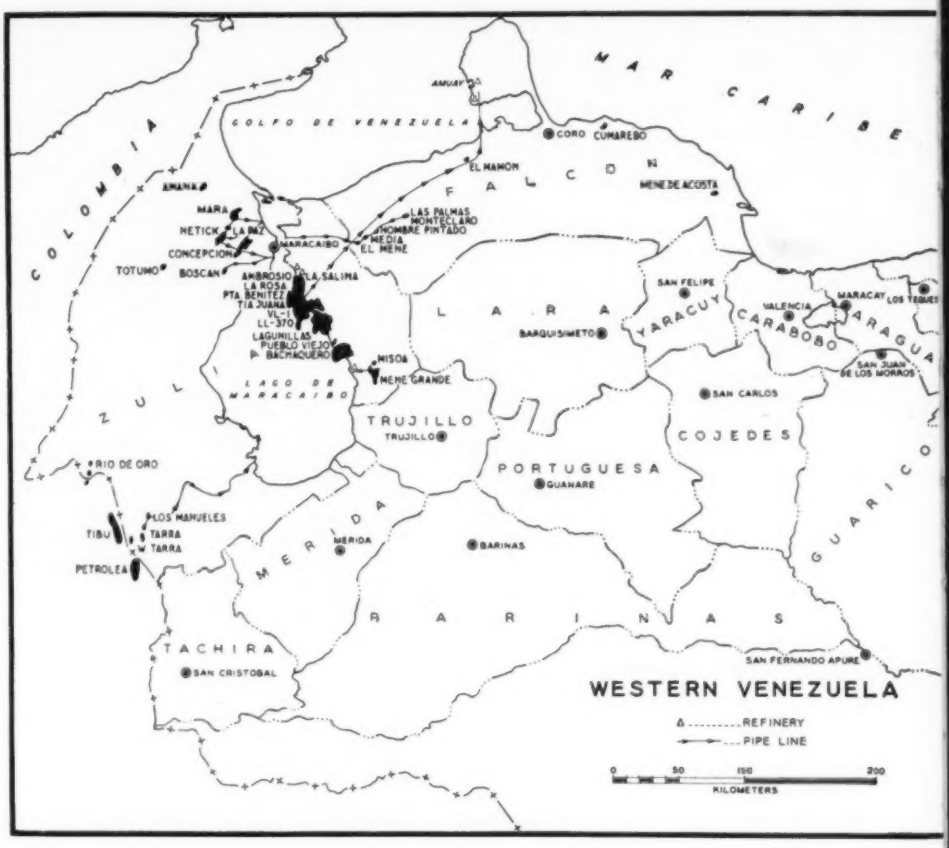
VENEZUELA PRODUCTION AT NEW HIGH



Senior camp staff at site of Creole Petroleum Corporation's new refinery. Water pipe line is in foreground.

By Anne Newman Sutton

1948 Was Marked by Unusual Activity in All Branches of the Industry. Production Increased 57.9 Million Barrels. Pipeline Outlets Were Enlarged and Refinery Construction Work Speeded.



FROM accurate figures for the first ten months of the year and with the last two months carefully estimated, it may be said that Venezuela oil production for 1948 approximated 492,546,000 barrels and surpassed 1947's production by 57,906,000 barrels, an increase of over 13 percent. Production figures in Tables I and II are by operators and in some instances do not show the breakdown for participating companies.

The total industry production for the week ending January 5 averaged 1,280,000 barrels per day. For the week ending November 22, an all-time-high daily average of 1,406,662 barrels was recorded. During this latter period the daily average for Creole Petroleum Corporation was 649,500 barrels; for Shell Caribbean Petroleum Company, 448,623 barrels; and for Mene Grande Oil Company, 229,812 barrels. These were new all-time highs for Shell and Mene Grande, whereas Creole's all-time highest daily average of 658,209 barrels occurred during the week ending September 27.

Of the total production the fields of western Venezuela produced 351,690,000 barrels or 71.4 percent. The Bolivar coastal field alone produced 267,874,000 barrels or 54.4 percent of the country's total. The fields of eastern Venezuela accounted for 140, 856,000 barrels or 28.6 percent. Most productive area in the east was the Guara (Guico) area of central Anzoategui with 34,204,000 barrels or about 6.9 percent of the country's total. Production from this area is practically the same as that reported in 1947.

Of the six leading producing companies, all except Sinclair showed a substantial increase over 1947. Creole, the leading producer, showed an increase of 19,609,000 barrels, a gain of nine percent over 1947. The Bolivar coastal field accounted for about 87 percent of this increase.

Creole's Quiriquire field in north Monagas produced 25,083,000 barrels which is an increase of 5,147,000 barrels over 1947. The Pedernales field also recorded an increase. The Jusepin-Mulata of Monagas and the Cumarebo field of Falcon showed decreases, but these fields are almost entirely drilled up and can be expected to show a continued production decline in the future. The company's total production for the year was 235,649,000 barrels.

The Shell Group registered an increase of about 29,356,000 barrels over 1947, an approximate gain of 24 percent. The principal contributor was the LaPaz field with a total production of 44,181,000 barrels, an increase of 16,777,000 over 1947. The Mara field produced 15,264,000, an increase of 5,865,000, and the Bolivar coastal field 70,517,000, an increase of 4,706,000. The Mene Grande field produced 16,494,000, an increase of 2,583,000 over 1947. Minor increases were recorded at La Concepcion and West Tarra, but Los Manueles and Tarra showed declines. Shell's total production was 151,594,000 for the year.

The Mene Grande Oil Company's total production for 1948 of 79,425,000 barrels showed an increase of 3,985,000 barrels or a little more than five percent over 1947. Contributing to this increase were the Nipa field in eastern Venezuela with about 4,220,000 barrels and the Bolivar coastal field with about 300,000. Appreciable increases were recorded at Fria, Leona, Oficina, Santa Rosa and Toco in eastern Venezuela and in the Mara field of western Venezuela.

Socony-Vacuum Oil Company's estimated production of 11,057,000 barrels for 1948 is an increase of approximately 900,000 over the previous year. This increase was derived largely from the Nipa field. The Chimiri field, discovered in 1948, contributed 225,000 barrels.

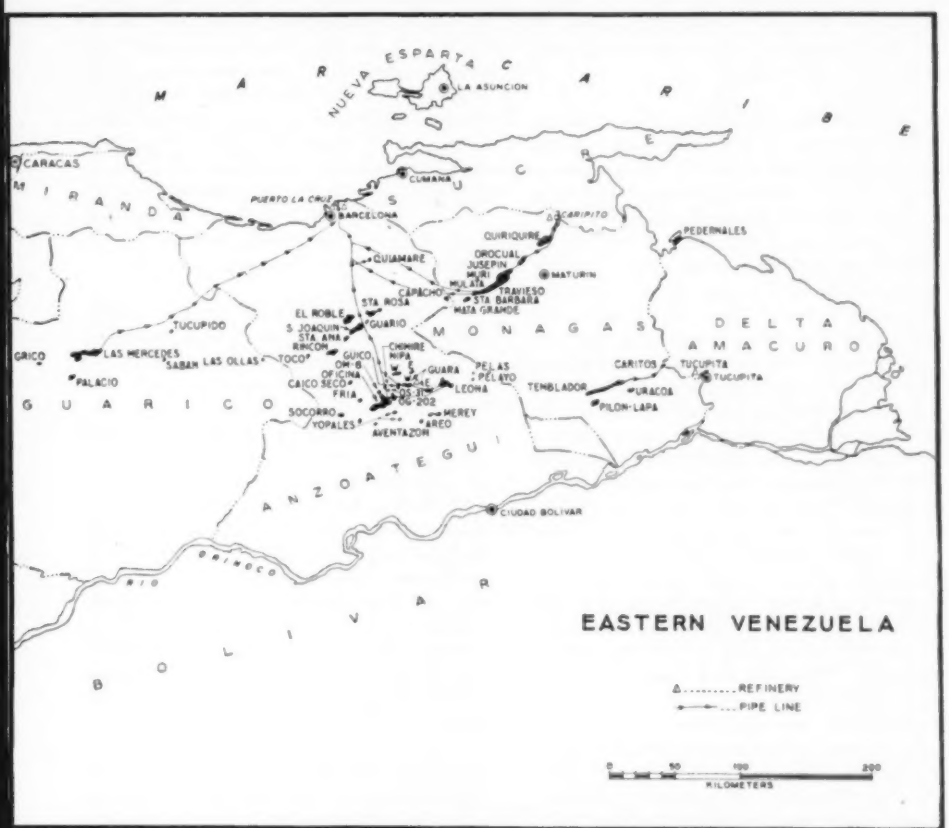
Sinclair Oil and Refining Company produced a total of 6,810,000 barrels, a decrease of 834,000 from 1947.

Production of Texas Petroleum Company for 1948 totaled 5,486,000 barrels, an increase of 3,051,000 or 125 percent. Principal contributors were the Tucupita field with 2,239,000, and Las Mercedes and Palacio fields with 2,005,000 and 537,000 respectively. The last two fields were placed on steady production with completion of Las Mercedes-Pamatacual pipeline in June. In the Mara field of western Venezuela it is estimated that the company's production for the year should approach two million barrels. This is a joint operation and production figures are included with that of the Shell Group.

The three leading producers, Creole, Shell and Mene Grande, together accounted for a total of 466,668,000 barrels or almost 95 percent of the industry total for the year.

A review of Venezuela's total cumulative production through 1948 by fields and companies is shown in Tables I and II. It will be observed that this amounts to 4,524,273,000 barrels. Of this, western Venezuela has produced 3,599,267,000 barrels or 79.6 percent, and eastern Venezuela has produced 925,006,000 or 20.4 percent. Of the production of western Venezuela, the Bolivar coastal field contributed 2,927,787,000 barrels, which is approximately 81 percent of the cumulative total for western Venezuela, and 64.7 percent of the country's cumulative total.

As indicated in Table I, the Mene Grande field of the Shell Group is the west's second largest all-time producing field and accounts for about seven percent of Venezuela's cumulative total. Third largest is LaPaz field, an area in which production has increased rapidly since the deeper Cretaceous horizons were discovered. During 1948 this field produced more than two and one-half times as much as the Mene Grande field. The four fields in eastern Venezuela that have contributed most to the country's cumulative production are the Quiriquire, the Jusepin-Mulata-(Guico).



Coating pipeline before submerging in Gulf of Coro. Photo courtesy Creole Petroleum Corp.

Santa Barbara, the Oficina and the Guara During the ten-month period ending October 31, 1948, a total of 736 wells were drilled in all Venezuela. A summary of these may be seen in the accompanying table.

Summary of Wells Drilled, Jan. 1 to Oct. 31, 1948

	Oil Wells	Gas Wells	Dry	Total
Field Wells	551	2	24	577
Outposts	89	3	16	108
Deeper Pool Tests	2	0	2	3
Exploratory Wells	13	2	32	48
Total	655	7	74	736
Total rigs in operation, Oct. 31, 1948				154

Creole, the country's largest producer, was active in both western and eastern Venezuela. In the Bolivar coastal field a total of 111 wells were drilled, of which 109 were completed as oil wells, one as a gas well and one as a dry hole. Production is from the Eocene and Miocene, and at the close of October 10 rigs were active in the field. In the Mara field one well was completed as a producer from the Cretaceous. In eastern Venezuela the company's greatest activity centered in the Quiriquire field where 56 producing wells and five dry holes were drilled. Production in this field is from the Pliocene. Six rigs were in operation at the end of October. Of the 17 wells drilled in the Jusepin-Mulata area, 14 were completed as oil wells and three were dry holes. Twelve oil wells and five dry holes were drilled in the Temblador field, five oil wells in the San Joaquin field, two in the Roble field and two at Pilon, south of Temblador.

Creole's exploratory effort during the year was country-wide. At the close of October nine exploratory wells had been completed and ten were drilling. Of the nine completions, six were abandoned as dry holes, one was abandoned as a small gas well, and two were successful. Well RPN-15, deeper pool test in the Roble field, was completed in November at total depth of 11,829 feet with an initial production of 599 barrels daily of 48.0 degrees API gravity oil from the Oligocene. Well JX-6 in northern Monagas was completed in October as a Cretaceous producer at a comparatively shallow depth, but initial production data has not been released. This well is of interest in that it is the first successful Cretaceous completion in eastern Venezuela. Of the unsuccessful wildcats, four were located in northern Monagas and three in Falcon. The ten exploratory wells drilling at the end of October were distributed widely. These were one each in the Delta Amacuro, Monagas and Anzoategui areas of eastern Venezuela, two in eastern Falcon, one in western Falcon, two in the Mara district of Zulia and two deeper pool tests in Lake Maracaibo.

Activities of the Shell Group were confined almost entirely to the Maracaibo basin. In the Bolivar coastal field a total of 190 wells were drilled, of which 188 were completed as oil wells and two were dry holes. Production is from the Miocene and Eocene, and at the end of October ten rigs were in operation. In the Mene Grande field on the east side of Lake Maracaibo in eastern Zulia, 15 oil wells were completed in the Eocene at an average depth of 3,080 feet. No drilling was carried out in Los Manueles and Tara fields of southwestern Zulia, but in the west Tarra field ten kilometers west of Tarra, one oil well was completed in the Cretaceous at a depth of 7,600 feet. In LaPaz field of northwestern Zulia three producers were completed in the Cretaceous, and three more in the Cretaceous were completed in the Mara field, a short distance to the north. In the Concepcion field, C-148, a deeper pool test was completed in August at total depth of 12,084 feet in the Cretaceous. The initial production gauged 1915 barrels daily of 37.0 degrees API gravity oil. This field was discovered in 1925 and, until the recent Cretaceous discovery, had produced only from the Eocene. Another discovery of great interest is Shell's Sibucara No. 5, a Cretaceous test on the Sibucara anti-cline, about nine kilometers west of the city of Maracaibo. At the end of October this well was drilling at 12,788 feet in the Cretaceous, and on a preliminary test gauged 1660 barrels daily of 36.0 degrees API gravity oil. In addition to the above the Shell Group at the end of October were drilling three exploratory wells in the Maracaibo basin and two in the State of Anzoategui about 72 kilometers southwest of Barcelona. On of the latter was testing at a total depth of 14,036 feet.

In the Bolivar coastal field of the Maracaibo basin, Mene Grande Oil Company completed 28 oil wells in formations of the Miocene and the Eocene. In the Mara field two successful wells were completed in the Cretaceous at an average depth of 9,200 feet. On October 31, 1948, the company obtained ownership on the Netick field in the Mara district of Zulia. This field, formerly owned by the Orinoco Oil Company (Pure Oil), has been a small producer from the Eocene. It lies along the trend and between the LaPaz and Mara fields and has excellent prospects for deeper Cretaceous production.

In eastern Venezuela Mene Grande's activity was confined largely to the central Anzoategui area where production is obtained from the Oficina and Merecure formations of the Mio-Oligocene. In the east and west Guara fields, five rigs were active and a total of 26 wells were drilled. Of these, 24 were completed as oil wells and two were dry holes. In the east and west Nipa fields nine rigs were active and 25 successful completions were effected at average depth of 8,630 feet. In the Oficina field 15 wells were drilled to average depth of 6,813 feet. Of these, 14 were completed as producers and one was a dry hole. Seven successful completions were made in the Leona field, and in each of the Santa Ana and Santo Rosa fields two wells were completed as successful producers.

During the first ten months of the year Mene Grande completed eight exploratory wells, and at the end of the period six were drilling and

one was rigging up. Of the eight completions, four resulted in new field discoveries. TM-1, discovery well for the Toco field, is located in west central Anzoategui about 20 kilometers west of the Santa Ana field. It was brought into production in February at a total depth of 7,950 feet for 590 barrels daily of 37.5 degrees API gravity oil. Since discovery, three oil wells and one gas well have been completed in this field. Well FZ-2, discovery well for the Fria field, 20 kilometers west of the Oficina field, was completed in March at a total depth of 6,802 feet. The initial gauge of the well showed 400 barrels daily of 40.9 degrees API gravity oil from the Oficina formation. Since its discovery, six oil wells have been completed in the field. MFS-1, new discovery in the Merey-Areo area, is located in southeastern Anzoategui, about 35 kilometers southeast of the Oficina field. The well was completed in September in the Oficina formation at a total depth of 6,417 feet for 332 barrels daily of 19.0 degrees API gravity oil. Inca-1 in west central Anzoategui about 5.5 kilometers NNE of Cachipo, was completed in August at a total depth of 7,218 feet for an initial production of 88 barrels daily of 43.7 degrees API gravity oil from the Oficina formation. CaM-5 in the Caico Seco area and Caris-1, 12 kilometers south of the Oficina field, were completed as gas wells in the Oficina formation. Apure No. 2, in the eastern part of the State of Apure, was abandoned in May as a dry hole at 7,842 feet. Apure No. 3, in north central Apure, was still drilling at the end of the period under review. In the Mara field of western Venezuela, Moga-1 was completed in March at a total depth of 9,640 feet. The initial gauge showed 76 barrels per day of 27.8 degrees API gravity oil from the Cretaceous. This was Mene Grande's first producing well in the Mara field. Men-2, northeast of the Mara field, and Poco No. 1 in southeastern Zulia were still drilling at the end of October.

In the central Anzoategui area of eastern Venezuela, Socony-Vacuum Oil Company completed eight oil wells in the Guara (Guico) field, four on the Guario dome of the San Joaquin field, five in the Nipa field and four in the Chimiri field. Production is from sands in the Oficina and Merecure formations of the Mio-Oligocene at depths ranging from 5,760 feet to 8,155 feet. The Chimiri field, discovered in January, lies along the same trend and about ten kilometers west of the western edge of the west Guara field.

During the period under review Socony completed four exploratory wells. La Pascua Nos. 1 and 2 near Valle de la Pascua in east central

TABLE I

Venezuela's All Time Production by Fields—Thousands of Barrels*

Field	Total Through 1944	1945	1946	1947	1948	Total Through 1948	Percent of 1948 Total	Percent of Total Through 1948
Eastern Venezuela								
Caico Seco	—	—	—	126	209	335	—	—
Capacho	—	7	—	—	—	7	—	—
Caritos	105	7	59	76	9	256	—	—
Chimire	—	—	—	1	225	226	0.1	—
Fria	—	—	—	—	374	374	0.1	—
Guara (Guico)	9,241	20,711	31,398	34,655	34,204	130,209	6.9	2.9
Jusepín-Mulata	43,831	28,775	29,845	27,393	23,015	152,859	4.7	3.4
La Ceiba	—	—	49	53	76	178	—	—
Leona	2,711	733	1,804	1,460	1,928	8,636	0.4	0.2
Mercedes	17	16	63	62	2,005	2,163	0.4	0.1
Merey-Areo	67	—	—	—	122	189	—	—
Nipa	—	4	982	3,815	8,038	12,839	1.6	0.3
Oficina	78,878	15,260	13,080	15,244	15,975	138,437	3.2	3.1
Palacio	—	—	—	—	537	537	0.1	—
Pelayo	—	—	—	16	43	59	—	—
Pedernales	9,036	—	—	442	957	10,435	0.2	0.2
Pelas	—	—	—	2	—	2	—	—
Pirital (Aripa)	—	35	22	14	9	80	—	—
Quiamare	367	94	74	79	35	649	—	—
Quiriquire	225,826	14,457	18,336	19,936	25,083	303,638	5.1	6.7
Roble (Anaco)	8,657	1,743	1,552	1,519	1,826	15,297	0.4	0.3
Saban	—	—	—	—	38	38	—	—
San Joaquin (Guario)	10,999	5,746	5,593	6,215	6,209	34,762	1.3	0.8
Santa Ana (Rincon Largo)	861	820	954	1,034	1,079	4,748	0.2	0.1
Santa Bárbara-Muri-Travieso	14,568	10,449	9,739	7,644	6,810	49,260	1.4	1.1
Santa Rosa	1,640	548	535	975	1,023	4,721	0.2	0.1
Temblador	18,082	2,102	2,286	2,390	3,477	28,337	0.7	0.6
Toco	—	—	—	—	371	371	0.1	—
Tucupido	—	—	7	2	950	959	0.2	—
Tucupita	—	15	402	1,501	2,239	4,157	0.5	0.1
Uracoa (Tabasca)	45	—	—	1	—	46	—	—
West Travieso (Mata Grande)	436	3,347	4,806	4,757	3,467	16,813	0.7	0.4
Yopales	167	—	121	673	523	1,484	0.1	—
All Others	1,905	—	—	—	—	1,905	—	—
Total—Eastern Venezuela	427,439	104,869	121,757	130,085	140,856	925,006	28.6	20.4
Western Venezuela								
Bolivar Coastal	910,680	118,589	145,485	158,630	175,743	1,509,127	35.7	33.4
	384,326	16,001	19,783	21,312	21,614	463,036	4.4	10.2
	706,472	52,271	60,553	65,811	70,517	955,624	14.3	21.1
	2,001,478	186,861	225,821	245,753	267,874	2,927,787	54.4	64.7
Amana	31	—	6	2	—	39	—	—
Boscan	—	—	—	—	302	302	0.1	—
Concepción	27,764	1,355	1,117	1,051	1,171	32,458	0.2	0.7
Cumarebo	32,461	1,885	1,775	1,859	1,692	39,672	0.3	0.9
El Mene	22,769	176	169	165	144	23,423	—	0.5
Hombre Pintado	3,256	242	228	257	260	4,243	0.1	0.1
La Paz	11,147	8,049	15,297	27,404	44,181	106,078	9.0	2.4
Los Manueles	33,888	1,933	1,937	1,400	1,056	40,214	0.2	0.9
Mara	—	1,141	3,439	9,399	15,264	29,243	3.1	0.7
Mene Grande	265,453	12,831	13,115	13,910	16,494	321,803	3.4	7.1
Netick	201	146	99	92	106	644	—	—
Tarra	54,957	3,873	3,768	2,960	2,612	68,170	0.5	1.5
West Tarra	—	—	—	303	515	818	0.1	—
All Others	4,354	—	—	—	19	4,373	—	0.1
Total—Western Venezuela	2,457,759	218,492	266,771	304,555	351,690	3,599,267	71.4	79.6
Total—All Venezuela	2,885,198	323,361	388,528	434,640	492,546	4,524,273	100.0	100.0

* Production estimated for November and December—1948.

Guarico were dry holes. Silvestre No. 2, located in the State of Barinas about 34 kilometers southeast of the town of Barinas, was completed in February at a total depth of 9,766 feet. Unconfirmed reports at the time were that the well flowed 800 barrels per days on ¼-inch choke of 26.0 degrees API gravity oil from Eocene sands in the 8,600-9,400-foot interval. Silvestre No. 3 was completed in September at a total depth of 8,886 feet, and at the end of October Silvestre No. 4 and Silvan No. 1 in the same general area were drilling at 8,889 and 8,960 feet respectively. Socony has not released any official information concerning the Barinas tests although there is reason to believe that production has been obtained. If true, it is of exceptional interest, since it would be the first discovery of importance in the remote Apure-Barinas basin.

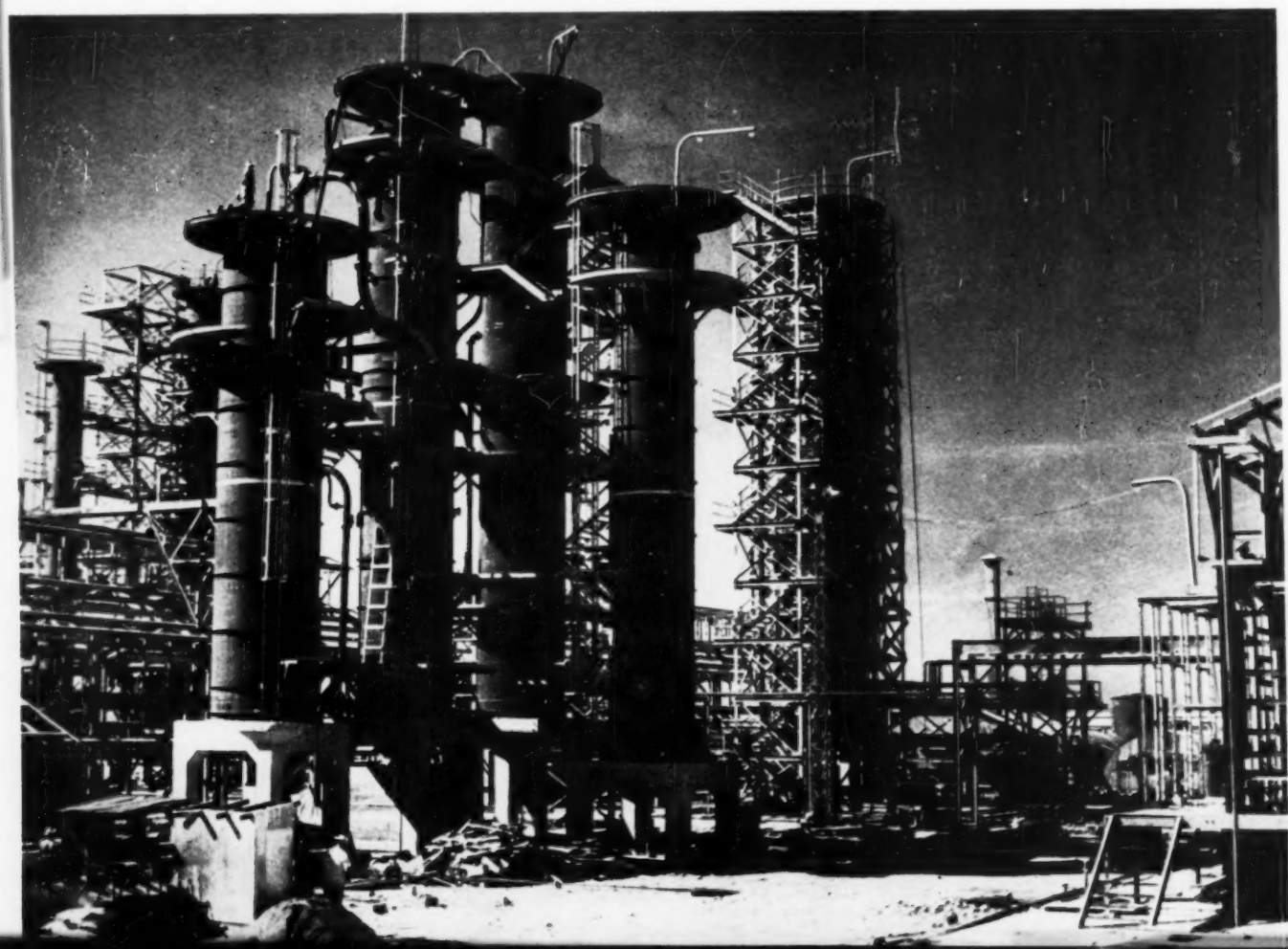
Sinclair Oil and Refining Company completed four producing wells in the Santa Barbara field of northwest Monagas. The company drilled three exploratory wells, two in Monagas and one in Guarico. All were tested and abandoned as dry holes.

In the Mercedes field of north central Guarico, the Texas Petroleum Company drilled 34 wells during the period under review. Of these, 28 were completed as oil wells, one as a gas well and five were dry holes. Four rigs were active at the end of October. In the Palacio field 20 kilometers south-southwest of Mercedes, 24 oil wells and three dry holes were drilled. Production at Mercedes and Palacio is from the Oligocene. The completion of the Mercedes-Pamatacual pipeline in June, 1948, supplied an outlet for the crude from these fields. In eastern Venezuela the company was active in the Tucupita field of the Delta Amacuro where 16 producing wells were completed, four of which were for Creole account. Outlet for the field is by shallow draft tankers to Point au Pierre refinery of Trinidad Leaseholds Ltd. in Trinidad. Ten exploratory wells were drilled during the first ten months of the year. Of these, two were drilled in Monagas in eastern Venezuela and eight in Guarico. All were dry holes with the exception of Mercedes No. 43 which is located nine kilometers northwest from the Palacio field. This well was completed in July at a total depth of 4,001 feet and gave an initial production of 216 barrels per day of 30.0 degrees API gravity oil from La Pascua formation of the Oligocene. It is considered the discovery of a new field, the Guavinita field.

Atlantic Refining Company's operations were confined to eastern Venezuela with greatest activity centered in the Tucupido field of northeastern Guarico where 15 wells were drilled, of which 11 were oil wells, three gas wells and one was a dry hole. This field, discovered at the close of 1946, produces from the Oligocene at a depth of approximately 5,600 feet. At the close of October four rigs were active in the field. In the Pelayo field of eastern Anzoategui, the company completed five wells of which three were oil wells and two dry holes. This field, which was also discovered in December of 1946, produces from the Oligocene at an average depth of 8,200 feet. The Saban field in east central Guarico, discovered in November, 1947, saw the completion of five oil wells, one gas well and one dry hole. The producing formations in this field, which occur in the Miocene and the Oligocene, are found at greatly varying depths. This field is not on production due to lack of outlet. Activity in Atlantic's Pelas, Pirital and Socororo fields was limited to the drilling of one oil well in each. The company completed four exploratory wells concerning which no information is available.

As of October 31, Phillips Oil Company was operating three rigs in its Mata Grande field in western Monagas. Eleven wells were drilled during the first ten months of the year, of which eight were completed as producers from the Miocene La Paica formation and three were dry holes. Four exploratory wells, Socorro Nos. 2 to 5 inclusive, in east central Guarico were drilled and abandoned as dry holes. A new field test, B-1, about eight kilometers northwest of the Santa Ana field in eastern Venezuela was drilling at 9,402 feet at the end of October.

Flash chamber and fractionating columns of cracking unit No. 1 at Shell Caribbean Petroleum Company's new Cardon refinery which goes on stream this month.



Richmond Exploration Company's activities were confined to the western part of the State of Zulia, west of Lake Maracaibo. In the Boscan field, Richmond's only active field, 16 wells were completed during the first ten months of the year. Of these, 15 were producers and one a dry hole. This field, which lies 40 kilometers southwest from the city of Maracaibo, was discovered in September of 1946. Production is obtained from the Oligocene and Eocene formations at an average depth of 7,700 feet. The oil has a gravity of 10.5 to 12 degrees API. A total of 177,900 barrels of oil were produced during the first ten months of the year for local use, but the field will not go on active production for several months or until the pipeline to Lake Maracaibo, a distance of some 30 kilometers, is completed. Eight rigs are active in the field.

Richmond continued its exploratory effort in its large holdings west of the Lake. Six exploratory wells were drilled, of which two were completed as commercial producers. Zulia 10-1, eleven kilometers northwest of the Boscan field, was completed in March. It was drilled to total depth of 9,992 feet, plugged back to 8,290 feet, and flowed initially at a rate of 400 barrels per day of 11 degrees API gravity oil from formations in the Oligocene and the Eocene. It is considered the discovery well for the Albaricos field. Zulia 36-1, discovery well for the San Jose field, is located 21 kilometers east of Machiques in the Perija district of Zulia. It was drilled to a total depth of 11,475 feet, plugged back to 10,947 feet, and completed in the Eocene for 90 barrels daily of 12.5 API gravity oil.

British Controlled Oilfields completed one well in the Hombre Pintado field of western Falcon.

Though less than in 1947, there was considerable activity in field exploration during the year. At the close of October 22 seismograph, seven gravimeter and 21 geological parties were engaged in field studies. Their company affiliation and distribution are shown in Table IV.

In addition to accelerated production, 1948 was a year of unusual expansion in other branches of the industry. June witnessed the completion of a 16-inch diameter oil line 157 miles long between Las Mercedes in Guarico and Pamatacual, the terminal just each of Guanta in the State of Anzoategui. S. A. Petrolera Las Mercedes, owned jointly and equally by the Texas Company and the Caracas Petroleum Company, S. A., owners of Las Mercedes oil field, built this line. Given this outlet for its oil, the field, which has an estimated potential of 16,000 barrels daily, is now being produced commercially. It serves also as on outlet for production from Atlantic's Tucupido field and Texas' Palacio field. A pump station at Guasimito with an estimated capacity of 67,000 barrels daily is a feature of the project.

In December Creole Petroleum Corporation completed its 24 and 26-inch diameter pipeline from Ule, near the eastern shore of Lake Maracaibo, to the refinery at Amuay on western Paraguana Peninsula, a distance of 145 miles. Now oil from the Maracaibo basin, which formerly had to be moved by tankers of shallow draft, can be transported directly and efficiently to a deep-water terminal. It is estimated that from 300,000 to 325,000 barrels of oil are reaching the Amuay installations daily through the line. Of this, approximately 60,000 barrels daily will be refined and the remainder stored in tanks for shipment to the world's markets. Other features of the project include two modernly-equipped pumping stations, one at Ule and one near Dabajuro, and the necessary tank farm construction and expansion.

Mene Grande Oil Company's warehouses at Puerto La Cruz terminal.

Under construction by Creole are a terminal and pump station at Catia La Mar on the Caribbean coast near La Guaira, and a bulk station at Nueva Caracas. An oil products line to unite the two terminals is now under construction.

TABLE II

Venezuela's All Time Production by Companies—Thousands of Barrels*

Company	Total Through 1948	Percent of Total Through 1948
Creole Petroleum Corp.	536,097	11.9
Mene Grande Oil Co.	290,870	6.4
Sinclair Oil & Refining Co.	49,260	1.1
Socony-Vacuum Oil Co.	34,720	0.8
Texas Petroleum Co.	10,254	0.2
Atlantic Refining Co.	1,138	—
Phillips Oil Co.	809	—
All Others	1,858	—
Total	925,006	20.4
Creole Petroleum Corp.	1,549,445	34.2
Shell Group	1,554,246	34.4
Mene Grande Oil Co.	463,275	10.3
British Contr. Oilfields	30,294	0.7
Richmond Exploration Co.	302	—
Orinoco Oil Co.	644	—
All Others	1,061	—
Total	3,599,267	79.6
Creole Petroleum Corp.	2,085,542	46.1
Shell Group	1,554,246	34.4
Mene Grande Oil Co.	754,145	16.7
Sinclair Oil & Refining Co.	49,260	1.1
Socony-Vacuum Oil Co.	34,720	0.8
Texas Petroleum Co.	10,254	0.2
British Contr. Oilfields	30,294	0.7
Atlantic Refining Co.	1,138	—
Phillips Oil Co.	809	—
Richmond Exploration Co.	302	—
Orinoco Oil Co.	644	—
All Others	2,919	—
Grand Total	4,524,273	100.0

The year 1948 was active also in continued construction and expansion of refineries. While existing plants provide Venezuela with all it needs of bulk oil products, new projects were needed to handle the growing export trade in refined products. Moreover, through agreement with the government, certain oil companies were under obligation to build refineries. As a result, two ultra-modern refineries were under active construction at Amuay Bay and Punta Cardon, both on Paraguana Peninsula, for Creole and Shell respectively; and two others at Puerto La Cruz, one for Sinclair and the other for Venezuela Gulf Refining Company. Only the earliest preliminaries of construction were in progress during the 1948 period for a fifth refinery project, that of Richmond Exploration Company. When completed, the 60,000 barrel-per-day refinery of Creole will step up the company's refining capacity to 142,000 barrels daily. Similarly, Shell Company's 50,000 barrel-per-day refinery will increase its capacity to 87,000 barrels daily. In brief, when all projects are in operation (Dec. 31, 1950), the country's refining capacity will be more than doubled. It is interesting to note that the capital investment will exceed $350,000,000. In addition to costs of the refineries proper, this sizable sum includes costs for improvement of roads and harbors; for the construction of docks with oil-handling facilities; for warehouses, storage tanks, electric power plants, evaporation plants; and for employee housing for some 30,000 people. While construction on the major projects has been going on for several years, the period under review witnessed most substantial progress on these and the beginnings on most of the others.

TABLE III

Venezuela's Nine-Year Production Record

Year	Production Barrels
1940	186,134,000
1941	228,131,000
1942	147,984,000
1943	179,399,000
1944	257,034,000
1945	323,361,000
1946	388,528,000
1947	434,640,000
1948*	492,546,000

*Last two months of 1948 are estimated.

WORLD OUTLOOK . . . PETROLEUM SUPPLY AND DEMAND

By Arthur D. Stewart

Arthur D. Stewart, economist of the foreign trade department of the Socony-Vacuum Oil Co., Inc., has been associated with the company and its predecessor, Standard Oil Co., of New York, since 1915. He was chief statistician of the North China department at Shanghai, China, for a number of years, and continued statistical studies of foreign markets after his return to the United States. In 1937 he became manager of the foreign division of the statistical department which later became the department of economics, and was appointed economist of the foreign trade department in 1945.

During World War II his great knowledge of the international oil industry was of much value to the various committees on which he worked. Among others he was chairman of the statistical sub-committee and chairman of the European Lubricant Advisory Committee and chairman of the statistical sub-committee of the Group on American Petroleum Interests in Foreign Countries reporting to the United States Senate Special Committee Investigating Petroleum Resources.

THE world oil supply picture today has improved considerably as compared with the situation a year ago. This improvement was accomplished in spite of the fact that the industry did not get all the well casing, line pipe, tank cars or refinery equipment that it wanted. The industry also was faced with rising costs and poticial uncertainties in many countries.

The supply problem, however, is not entirely solved and the industry cannot relax in its efforts to build up safe reserves. Industry must continue to advocate efficient consumption and the practice of consumer conservation of both heating oils and motor fuels. While the industry has not as yet built up adequate working stocks in all areas of the world, nor has it achieved the prewar position of a surplus crude production potential, it is the opinion generally that many of the bottlenecks of supply are now broken.

The petroleum industry not only has increased world capacities for crude production, refining, transporting, and storing but at the same time has met unprecedented post-war consumer demand both here and abroad. Normal replacements and expansion which were delayed during the war years had to be superimposed upon the increased facilities needed to care for the unexpected and unprecedented post-war oil needs. The task confronting the industry was looked upon as one that would require many years to complete and, therefore, the period of shortages or tight supply situation was expected to continue for a number of years. However, the present world supply/demand outlook indicates that we are now or will be shortly changing over from a period of shortages to a period of adequate supply, which was generally the prewar condition.

This more optimistic outlook is contingent to a large extent upon a greatly accelerated development of the Middle East.

The record of the past outlook for world demand reflect the post-war achievement and the tremendous tasks still confronting the petroleum industry:

World Demand*

Excluding U.S.S.R. and Satellite Countries
Thousands of Bbls. Daily (T/B/D)

		Increase Versus Previous Year	
Pre-War	**T/B/D**	**T/B/D**	**%**
1935	4,150		
1936	4,524	374	9.0
1937	4,844	320	7.1
1938	4,886	42	0.9
1939	5,190	304	6.2
War Years			
1940	5,399	209	4.0
1941	5,648	249	4.6
1942	5,353	(295)	(5.2)
1943	5,912	559	10.4
1944	6,650	738	12.5
1945	6,940	290	4.4
Post-War			
1946	7,065	125	1.8
1947	8,022	957	13.5
1948**	8,822	800	10.0
1949	9,360	538	6.1
1950	9,831	471	5.0
1951	10,268	437	4.4
1952	10,721	453	4.4
1953	11,192	471	4.4

( ) Decrease.
* Including Military.
** Partly Estimated. Note that 1948 demand exceeded 1938 by 3,936,000 barrels daily or 80.6%.

The foregoing record is indicative of the remarkable achievement of the industry in providing the raw materials, the processing, transporting and distributing of petroleum products to meet the unexpected and unprecedented post-war world demand. This has been accomplished despite many impediments.

However, the foregoing data also indicate that the industry still has before it the great task to provide increasingly larger world supplies during the next five years. To meet this responsibility the industry must undertake further larger capital investments throughout the world in order to increase crude productive capacity and to provide adequate refining, transportation, storage and distributing facilities.

During the year 1948 there has been considerable expansion in transportation, storage, and distribution facilities in most areas throughout the United States. Therefore, the situation today regarding product inventories has improved greatly over that of a year ago so that the industry is now in a better position to meet the peak winter demand for heating oils, and the peak summer demand for motor fuel.

Both domestic production of raw materials and domestic consumption reached peak levels during 1948, surpassing all previous years. Crude oil production for 1948, very likely, will reach 5,500,000 barrels daily as compared with 5,085,000 b/d in 1948, an increase of 415,000 b/d or 8%. Production of natural gasoline and benzol will average 400,000 b/d as compared with 364,000 b/d in 1947, an increase of 36,000 b/d or 10%. Domestic demand for crude and products will reach a high level of about 5,900,000 b/d as compared with 5,449,000 b/d for 1947, an increase of 451,000 b/d or 8%.

Whereas a year ago published outlooks indicated generally declining production of crude in the

United States, it is now foreseen that increasing production will continue over the next five years by an annual increment of about 150,000 b/d. The supply of natural gasoline and benzol is expected to rise from 400,000 b/d in 1948 to 540,000 b/d in 1953.

Total exports of crude and products from the United States for the year 1948 will average probably about 384,000 b/d as compared with 451,000 b/d for 1947, a decline of 17%. Continued downward trend in exports is foreseen over the next five years, declining to 191,000 b/d in 1953. Governmental control of exports from the United States is expected to continue but quotas probably will be modified to conform with current supply/demand situation of each product. Export quotas will depend to a large extent upon the aid program of the European Co-operation Administration.

Continued upward trend is expected in domestic demand for crude and products reaching a level of over 7,000,000 b/d in 1953 as compared with 5,900,000 b/d in 1948. The graphical chart showing world demand illustrates the large volumetric changes and the higher upward trend in United States domestic demand during the present post-war era as compared with pre-war.

United States has passed for the first time since a few years in the 20's from a net exporter to a net importer in order to close the gap between available domestic supplies and total requirements. It is expected that increasingly larger imports will be needed but not at a very rapid annual rate of increase. To balance requirement, imports of only 526,000 b/d is foreseen for 1953 as compared with the average 1948 rate of 474,000 b/d. During the past few years most of the published forecasts stated that the United States would have to import about 1,000,000 b/d in the near future to close the gap between domestic supplies and requirements. Notwithstanding the substantial rise in demand, however, it is now apparent that required imports are not expected to rise so rapidly. In view of the more optimistic outlook regarding indigenous raw materials, required imports of 1,000,000 b/d may not be necessary for many years.

According to published reports on refinery building programs in the United States, working capacity will rise to 6,034,000 b/d in 1949 as compared with 5,859,000 b/d in 1948, an increase of 175,000 b/d. Petroleum refineries in the United States have operated during the year at a very high capacity ratio of over 95% indicating the need of additional facilities to provide a safer working margin. Although complete factual data regarding expansion program after 1949 are not available, no serious bottleneck is expected in this connection. Most of the oil companies engaged in refining are carrying out long range refining expansion in order to keep abreast of rising demand.

The foregoing outlook regarding supply and demand for the United States covering the coming five years has been predicated on the assumption that a recession or a war will not occur during the year 1949-1953 inclusive.

Table No. 1

World Supply—Crude Oil and Allied Products Production
(Excluding Russia and Satellite Countries)
Thousands of Barrels Daily (T/B/D)

Areas	1938 T/B/D	1938 % of Total World	1946 T/B/D	1946 % of Total World	1947 T/B/D	1947 % of Total World	1948* T/B/D	1948* % of Total World	% Inc. Vs. 1947
Crude									
United States	3,327	70	4,751	68	5,085	66	5,500	64	8
Caribbean	623	13	1,181	17	1,316	17	1,415	16	8
Other W. Hemisphere	222	5	255	4	274	4	304	4	11
Total W. Hemisphere	4,172	88	6,187	89	6,675	87	7,219	84	8
Marshall Plan—Europe	13	0	32	0	33	1	44	1	33
Near & Middle East	326	7	695	10	833	11	1,120	13	34
Other E. Hemisphere	215	5	49	1	98	1	194	2	98
Total E. Hemisphere	554	12	776	11	964	13	1,358	16	41
Total Foreign	1,399	30	2,212	32	2,554	34	3,077	36	20
Total World—Crude	4,726	100	6,963	100	7,639	100	8,577	100	12
Natural Gasoline Benzol, etc.									
United States	146	54	322	84	364	89	400	89	10
Foreign	124	46	61	16	47	11	50	11	6
Total World Allied Prod.	270	100	383	100	411	100	450	100	10
Total World Supply	4,996	—	7,346	—	8,050	—	9,027	—	12
Total World Supply of Raw Materials									
United States	3,473	70	5,073	69	5,449	68	5,900	65	8
Foreign	1,523	30	2,273	31	2,601	32	3,127	35	20
World	4,996	100	7,346	100	8,050	100	9,027	100	12

* Partly Estimated.

Table No. 2

World Demand for Petroleum Crude and Products
(Excluding Russia and Satellite Countries)
Thousands of Barrels Daily (T/B/D)

Areas	1938 T/B/D	1938 % of Total World	1946 T/B/D	1946 % of Total World	1947 T/B/D	1947 % of Total World	1948* T/B/D	1948* % of Total World	1948* % Inc. vs. '47	1949 T/B/D	1949 % of Total World	1953 T/B/D	1953 % of Total World
United States	3,115	64	4,912	68	5,499	68	5,900	67	8	6,200	66	7,050	63
Other W. Hemisphere	464	9	832	12	947	12	1,001	11	6	1,057	12	1,431	13
Total W. Hemisphere	3,579	73	5,744	80	6,396	80	6,901	78	8	7,257	78	8,481	76
Marshall Plan-Europe	774	16	637	9	833	10	1,013	12	22	1,138	12	1,612	14
Other E. Hemisphere	533	11	765	11	828	10	908	10	10	965	10	1,099	10
Total E. Hemisphere	1,307	27	1,402	20	1,661	20	1,921	22	16	2,103	22	2,711	24
Total Foreign	1,771	36	2,234	32	2,608	32	2,922	33	12	3,160	34	4,142	37
Total World	4,886	100	7,146	100	8,057	100	8,822	100	9	9,360	100	11,192	100

* Partly Estimated.

Situation in Foreign Countries

During the year 1948 the rate of crude oil production abroad increased substantially, rising from 2,554,000 b/d in 1947 to 3,077,000 b/d, an increase of 523,000 b/d or 20%. Table No. 1 shows that the larger part of this increase has been in the Eastern Hemisphere particularly in the Near and Middle East, where the output rose from 833,000 b/d to 1,120,000 b/d or 34%. Demand for crude and products in foreign countries will, very likely, reach a level of 2,922,000 b/d for 1948 exceeding all previous years as compared with 2,608,000 b/d for 1947, a gain of 314,000 b/d or 12%. Table No. 2 indicates that more than one-half of this increase has been in countries of Europe participating in the Marshall Plan where demand reached a level of 1,013,000 b/d or 22% over 1947.

For many years exports of crude and products from the United States filled the gap between available net supplies from foreign indigenous sources and domestic demand in countries abroad. As already pointed out beginning with the year 1948 this condition has been reversed—foreign produced supplies are now required to bridge the supply/demand gap in the United States. Accordingly, foreign crude resources are being developed in order to meet growing domestic demand in countries abroad and to provide for net exports.

Proposed plans for increasing crude productivity, construction of pipelines, and expansion of refining facilities indicate that there will be sufficient total foreign indigenous supplies of raw materials to meet domestic demand and net exports to the United States. Total foreign indigenous supplies should rise from 3,127,000 b/d in 1948 to 4,645,000 b/d in 1953, or an average yearly increment of about 300,000 b/d.

Domestic demand in countries abroad will continue to grow from 2,922,000 b/d to 4,142,000

Table No. 3

Growth In World's Petroleum Supply and Demand
1948-1953 Inclusive
Thousands of Barrels Daily (T/B/D)

Year	Indigenous Supplies Incl. Natural Gasoline, Benzol, etc. T/B/D	Increase Vs. Previous Year T/B/D	%	Domestic Demand** T/B/D	Increase Vs. Previous Year T/B/D	%
United States						
1948	5,900*	—	—	5,900*	—	—
1949	6,080	180	3.1	6,200	300	5.1
1950	6,225	145	2.4	6,450	250	4.0
1951	6,390	165	2.7	6,650	200	3.1
1952	6,565	175	2.7	6,850	200	3.0
1953	6,740	175	2.7	7,050	200	2.9
Foreign (Excluding U.S.S.R. & Satellites)						
1948	3,127*	—	—	2,922*	—	—
1949	3,465	338	10.8	3,160	238	8.1
1950	3,780	315	9.1	3,381	221	7.0
1951	4,055	275	7.3	3,618	237	7.0
1952	4,340	285	7.0	3,871	253	7.0
1953	4,645	305	7.0	4,142	271	7.0
Total World (Excluding U.S.S.R. & Satellites)						
1948	9,027*	—	—	8,822*	—	—
1949	9,545	518	5.7	9,360	538	6.1
1950	10,005	460	4.8	9,831	471	5.0
1951	10,445	440	4.4	10,268	437	4.4
1952	10,905	460	4.4	10,721	453	4.4
1953	11,385	480	4.4	11,192	471	4.4

* Partly Estimated.
** Not including Inventory Increase.

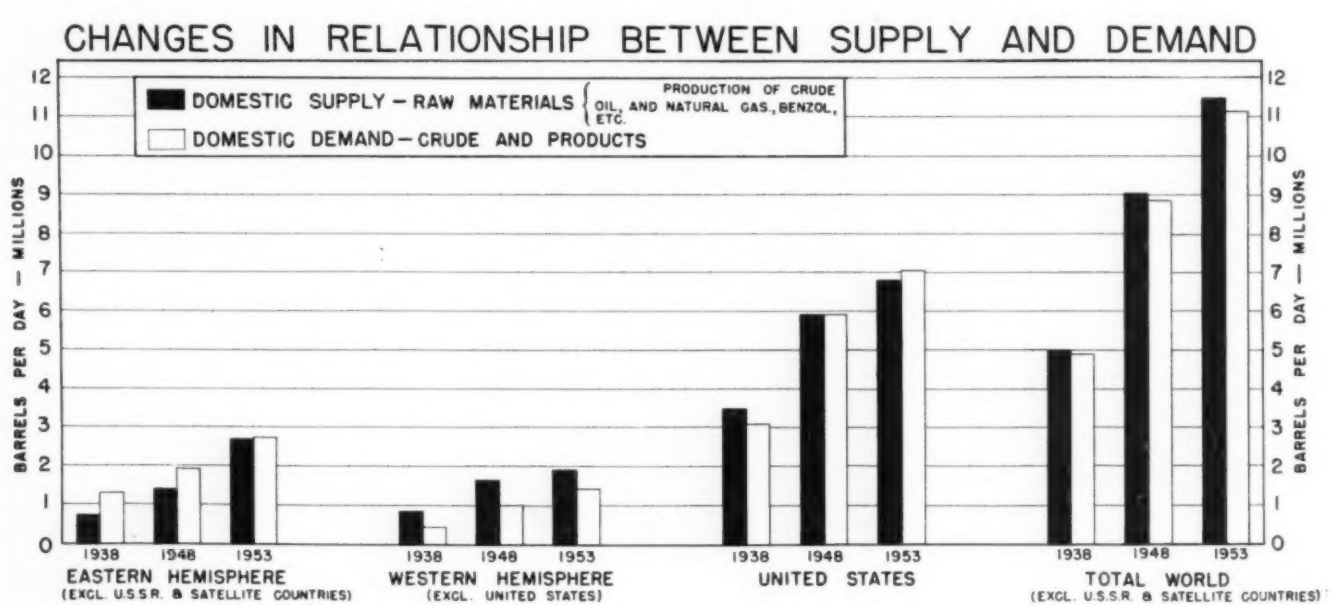
in 1953, an average annual increment of 240,000 b/d. The graph of world demand illustrates the large increase in volume and the faster rate of growth of the post-war demand as compared with pre-war.

The per capita consumption of oil in Europe is only 57 gallons as compared with 625 gallons in the United States which now seem to indicate the possibility of a very large potential demand. However, an examination of the economy of Europe and other countries of Eastern Hemisphere indicates that there are limitations to the extent that many countries can support the importation and maintenance of a large number of present-day high cost motor cars. The same is true regarding oil burning equipment. Furthermore, retail prices of petroleum fuels are generally high due largely to import duties and sales taxes. In some countries the consumption of motor fuel is controlled by consumer rationing. Furthermore, government approval is required generally abroad for the conversion from coal to oil. There are indications of a trend back to the use of coal in several countries. To conserve foreign exchange and bring about a more favorable balance of trade, most governments restrict the rate of imports of petroleum products through licenses or quotas. Nearly all countries abroad must accomplish increasingly larger agricultural or industrial production. Also larger export trade is necessary in order that their economy can support the importation of additional quantities of petroleum products and oil consuming equipment.

Present regulations and measures restricting or retarding the use of petroleum products may be attributed largely to the fact that many countries abroad are in the midst of a post-war period of rehabilitation, together with economic and political readjustments. When and to what extent can these countries emerge from this period to one of economic and political stability? While reports indicate that good progress is being made in the post-war recovery of several countries particularly Western Europe, conditions generally are not considered good in many Eastern countries. Furthermore, many trade and currency problems are still to be solved. Most of the countries have yet to demonstrate conclusively that complete economic recovery and stable governments will be achieved in the near future. Europe has still to give assurance of becoming self-sustaining and independent of American aid. Under these conditions together with the tense international situation, the demand outlook today for petroleum products is uncertain for a large part of the Eastern Hemisphere. Therefore, it would seem advisable to review from time to time the petroleum demand outlook in connection with the economic and political developments abroad.

Refining capacity of the Eastern Hemisphere is totally inadequate to meet its needs of finished products. Europe and the Mediterranean areas are especially in need of additional refining facilities for the following reasons:—

1. Plants damaged or destroyed during the war.
2. Plants shut down during the war and are still under repair or reconstruction due to lack of materials or for other reasons.
3. Refineries of the Caribbean area must sup-


CHANGES IN RELATIONSHIP BETWEEN SUPPLY AND DEMAND
DOMESTIC SUPPLY — RAW MATERIALS { PRODUCTION OF CRUDE OIL, AND NATURAL GAS, BENZOL, ETC.
DOMESTIC DEMAND — CRUDE AND PRODUCTS
BARRELS PER DAY — MILLIONS
0 1 2 3 4 5 6 7 8 9 10 11 12
1938 1948 1953
EASTERN HEMISPHERE (EXCL. U.S.S.R. & SATELLITE COUNTRIES)
WESTERN HEMISPHERE (EXCL. UNITED STATES)
UNITED STATES
TOTAL WORLD (EXCL. U.S.S.R. & SATELLITE COUNTRIES)

ply increasing quantities to meet own Hemisphere's requirements including larger exports to the United States. Therefore, diminishing supplies are left for the Eastern Hemisphere.

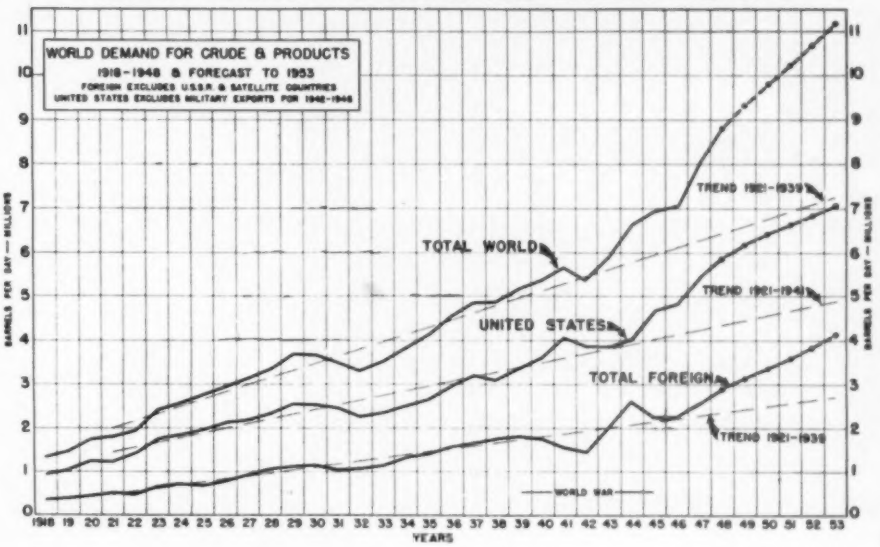
4. Decline of imports of finished products from the United States.
5. Discontinuance of imports of finished products from Romania and Russia.
6. Increasing crude oil production in the Near and Middle East necessitates the creation of new refining centers in or near the large consuming areas of Europe.

According to plans publicly announced, the petroleum industry will undertake extensive expansion of refining facilities in both Eastern and Western Hemispheres. A tabulation of the proposed additions and new plants indicates that the intake capacity of refineries of the Western Hemisphere outside the United States will rise from 1,600,000 b/d in 1948 to 2,100,000 b/d in 1953. The Eastern Hemisphere excluding U.S.S.R. and satellite countries will rise from 1,500,000 b/d in 1948 to 2,900,000 b/d in 1953.

Runs to stills in European refineries are larger today than a year ago reflecting primarily the going on stream of certain war-damaged plants and the trend to operate for maximum fuel oil yields. On the other hand, the closing of the Haifa, Palestine refinery with a capacity of 83,000 b/d has placed an additional load on plants located in the Persian Gulf, the Caribbean area, and Europe. Early resumption of operation of this plant is hoped for in order to improve the supply situation of the Mediterranean area. The refinery bottleneck of the Eastern Hemisphere West of Suez is not expected to be completely eliminated for several years. Present day shortages of steel together with unsettled political conditions and problems of financing are factors delaying the construction of much needed additional crude processing facilities in Europe and the Mediterranean area.

World supply and demand outlook indicates a number of important changes in the position of supply versus demand and also shifts in the international flow of petroleum products. One of the important changes already observed is the reversal in position of the United States from a net exporter to a net importer of petroleum supplies. With reference to this situation, substantial crude oil production has been developed in South America due largely to the foresight and courage of the American oil industry. Therefore, the United States is fortunate in having a nearby source of crude to meet its indigenous supply deficiency. However, it must be realized that South America as a source of future supply to meet possible large shortages in the United States is contingent in turn upon the development of crude oil resources in the Middle East together with the expansion of refining facilities in Europe. Middle East crude production capacity must be increased, pipeline transportation provided, and refining facilities expanded in order to reduce the drain on South America by countries of the Eastern Hemisphere.

POST-WAR UPWARD TREND IN DEMAND EXCEEDS PRE-WAR



Both the Eastern and Western Hemispheres will become for the most part self-sufficient within the next five years. Shipments from the Western Hemisphere to the Eastern Hemisphere will decline and movement will be confined largely to lubricants and specialty products.

The supply/demand picture for the entire Western Hemisphere including the United States supports the prevailing opinion that the production of raw materials within the Western Hemisphere may be adequate to meet total requirements and that the importation into the United States of crude oil from the Middle East may not be statistically required to balance demand. However, looking beyond the next five years if production within the Western Hemisphere does not provide for sufficient supplies to meet total requirements, imports from the Middle East would be needed to balance demand. Comparatively small quantities of cross hauling between the Eastern and Western Hemispheres will continue due to contractual obligations and movement of supplies for military and governmental purposes.

As already observed, the proposed greatly accelerated Middle East crude oil production, together with the expansion of refining facilities in the Eastern Hemisphere will cause a displacement of shipments from the Caribbean area to Europe. A substantial part of the displaced shipments to Europe will be needed in increasingly larger quantities to meet the deficit in the United States.

Managers of marine operating departments of several oil companies have announced that the industry tanker tonnage position today has greatly improved over that of a year ago. The post-war adjustment difficulties are apparently over, with the outlook today much more optimistic. Sufficient tankers are expected to be available over the next few years to meet worldwide transportation requirements, provided that there are no great delays in the completion of proposed Middle East pipelines.

These changes in the relationship of supply versus demand and also the shift in the international flow of oil are all dependent to a large extent on the development of producing capacity in the Middle East, laying of pipelines, and expansion of refineries. The consummation of the proposed plans for the expansion of producing, transportation and refining facilities in the Eastern Hemisphere will depend largely upon the availability of equipment and materials. Foreign exchange controls, European Recovery Program, import/export controls, quality of products, tanker situation and lack of refining facilities are also some of the factors affecting international flow of petroleum. The present day economic and political instability in many countries of the Eastern Hemisphere together with the tense international relations are further contributing factors retarding the carrying out of expansion programs.

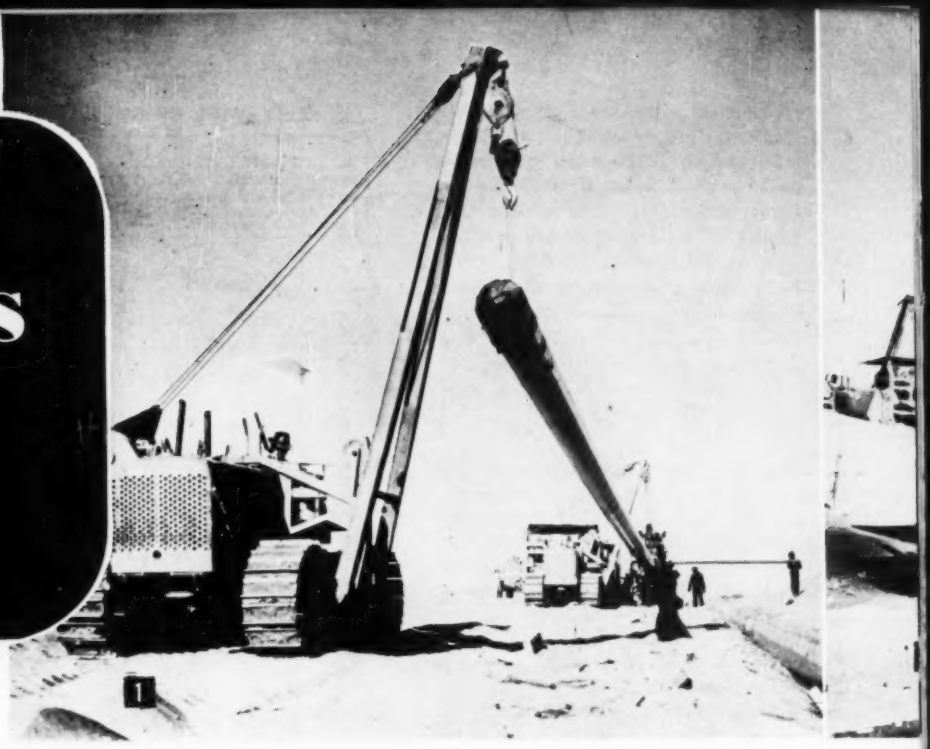
Conclusions

The substantial improvement in the world supply/demand situation today as compared with a year ago reflects the remarkable progress, notwithstanding many delaying factors, achieved by the petroleum industry in its program to increase producing capacity and to expand refining, transportation and storage facilities.

However, the world supply problem is not yet entirely solved and the industry must continue its efforts to build up safe reserves and at the same time to meet increasing world demand for oil which is so essential for the maintenance and improvement of the standard of living throughout the world. Its past record of achievements leaves little doubt that the industry can successfully meet this great task provided that it can continue to operate in an economy of free private enterprise, with adequate incentives, and minimum government controls.

DIESEL PIPELAYERS

5 crawler tractors lay 15000 feet of 20 inch pipe a day



Doping, wrapping and laying 15,000 feet of 20-inch pipe in a ten-hour working day is a record set by Morrison Bros. Co., on a project near Kermit, Texas. A fleet of five International diesel crawler tractors, paced by a big International TD-24 did the heavy work. Operation described in sequence as follows:

Fig. 1. International diesel TD-18 supports front end of 20-inch pipe while TD-24 follows with wrapping and doping machine.

Fig. 2. Dope truck with International-powered mixer containing 3000 lbs. of dope is towed behind TD-24.

Fig. 3. Diesel tractor equipped with Superior side boom lowers section of 20-inch pipe into trench.

Fig. 4. TD-24 supports pipe and doping machine. Doping and wrapping process is essential for protection of pipe.

Fig. 5. Smaller diesel (left foreground) supports forward end of pipe during doping and wrapping process.

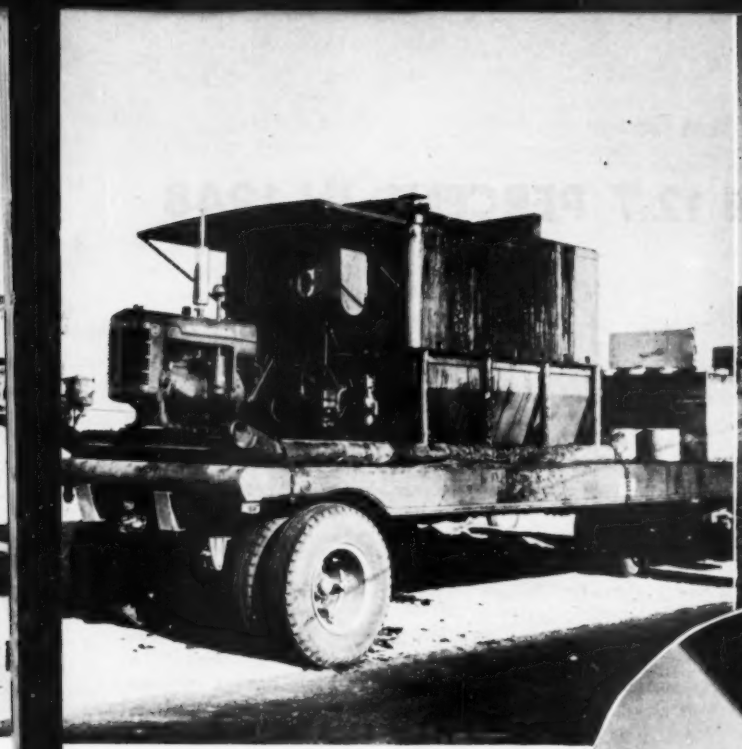
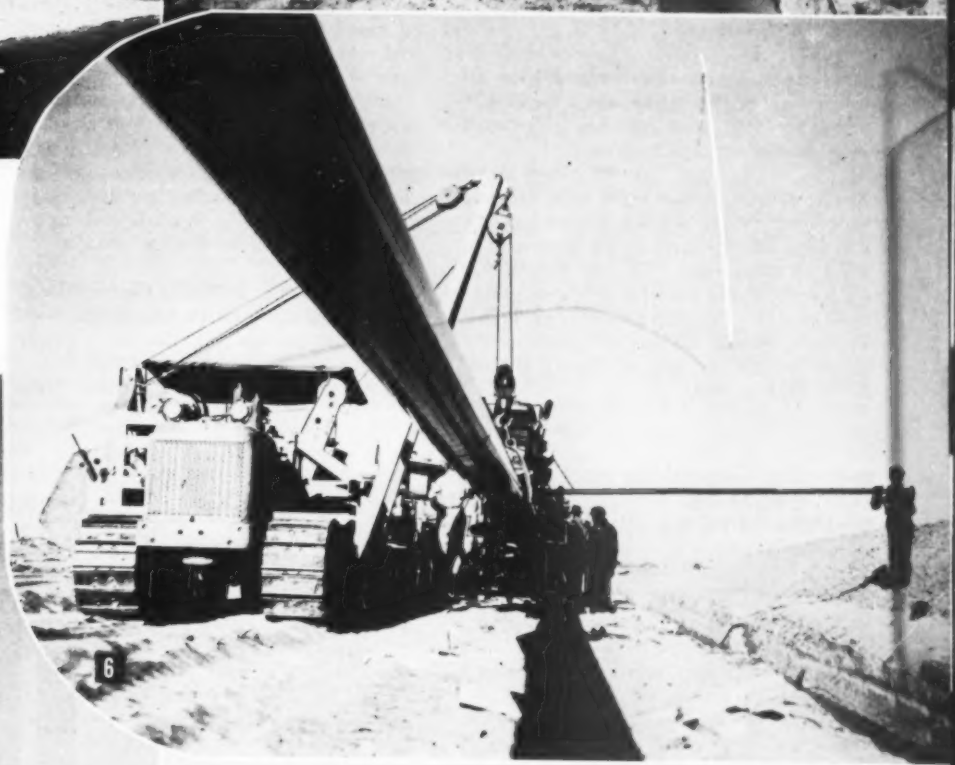
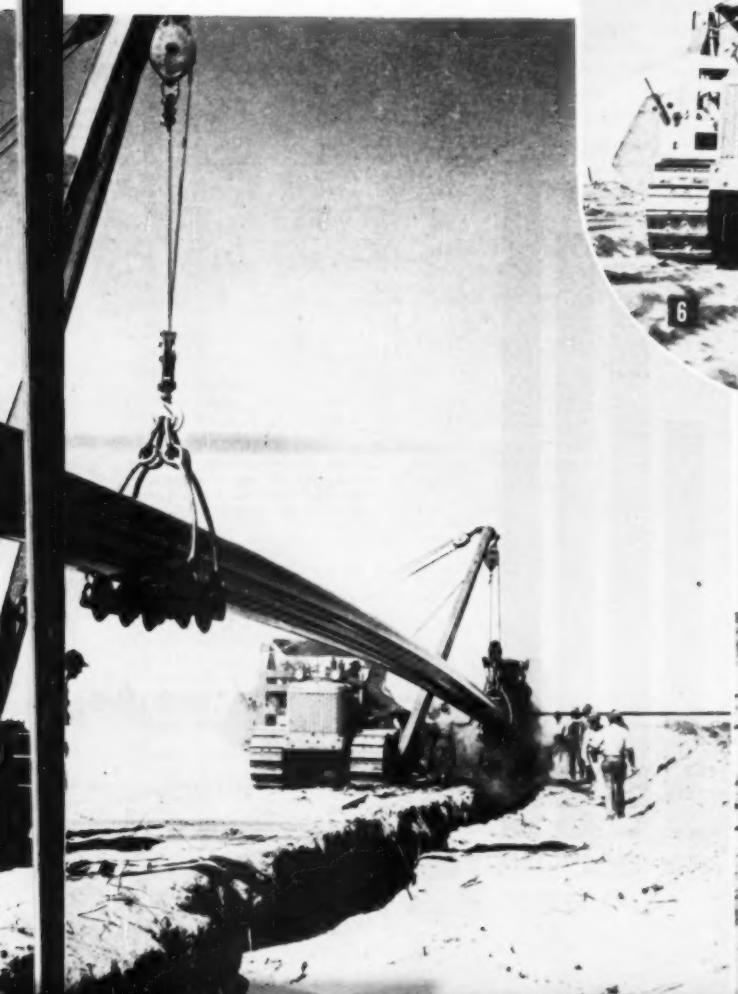


Fig. 6. Counterweights on TD-24's outboard side balance terrific weight of pipe during doping operation.

Fig. 7. Equipped with Bucyrus-Erie angle-dozer, diesel backfills after pipe is laid.





WORLD PRODUCTION ROSE 12.7 PERCENT IN 1948

WORLD production of crude oil increased 12.7 percent in 1948 to 9,363,600 barrels daily average. As the year closed, production was over 9,800,000 barrels daily. The increase of 1,056,800 barrels daily average compares with an increase of nine percent or 769,900 barrels daily average in 1947 over 1946.

The western hemisphere produced 77.8 percent of the world's total, dropping from 81 percent in 1947, while the eastern hemisphere produced 22.2 percent of the world's oil, compared with 19 percent the previous year.

North American oil output averaged 5,705,200 barrels daily in 1948. This was a rise of 8.35 percent over 1947. South American fields showed an increase in output of 9.8 percent.

By dint of drilling about 39,000 wells compared with 33,000 the previous year, United States oil men were able to enlarge output 8.4 percent to 5,512,700 barrels daily. This was 59 percent of the world's oil and compares with a percentage of 62 in 1947. Due to discoveries in the Prairie Provinces, Canada increased its production 53 percent in 1938 and may be expected to show further gains in 1949.

South American and Caribbean production rose 9.8 percent in 1948 to 1,575,800 barrels daily or 16.8 percent of world output. Virtually all of the increase came from Venezuela where the drilling of about 890 new wells added 137,000 barrels to average daily output. As the second largest producing nation, Venezuela provided 14.4 percent of the world's petroleum in 1948 compared with 14.2 percent in 1947.

Most spectacular production increases in crude output took place in the Middle East as a result of greater tanker facilities for lifting both crude and products. Local refineries in the area contributed to the enlarged outlet by operating greatly in excess of their rated capacities. This was possible partly because of the large relative demand for fuel oil in Europe. Many refineries are operating cracking stills as topping units, producing straight-run gasoline, intermediates and fuel oil, and this results in nearly doubling possible crude consumption in some instances.

Average production of Middle Eastern fields for 1948 was 1,180,900 barrels daily compared with 864,200 the previous year. Increase percentage was 36.7 and was almost as much in terms of volume as that recorded by the United States. The Middle East produced 12.6 percent of the world's crude in 1948 and 10.3 percent in 1947.

Only country in the Middle East which did not show an increase was Iraq. This was due entirely to political disturbances in Palestine which shut down the Haifa pipeline. Average production for the year was down 28 percent to 70,900 barrels daily, and at the end of the year was down to about 49,000 barrels daily.

At the close of the year Kuwait production was close to 200,000 barrels daily and daily average for the entire year was about 130,000 barrels daily, an increase of 192 percent over 1947. Kuwait Oil Co., Ltd., was running nine rigs toward the end of 1948 and this number probably will be increased in 1949 as more equipment and drilling crews become available.

During 1947 the Kuwait company signed a long term contract with Royal Dutch Shell interests covering the sale of large quantities of crude. Gulf Oil Corp., partner with Anglo Iranian Oil Co. in the Kuwait concession is preparing to run a large volume of Kuwait crude in the United States. Recently it was announced that Gulf will spend $40 million enlarging its Philadelphia

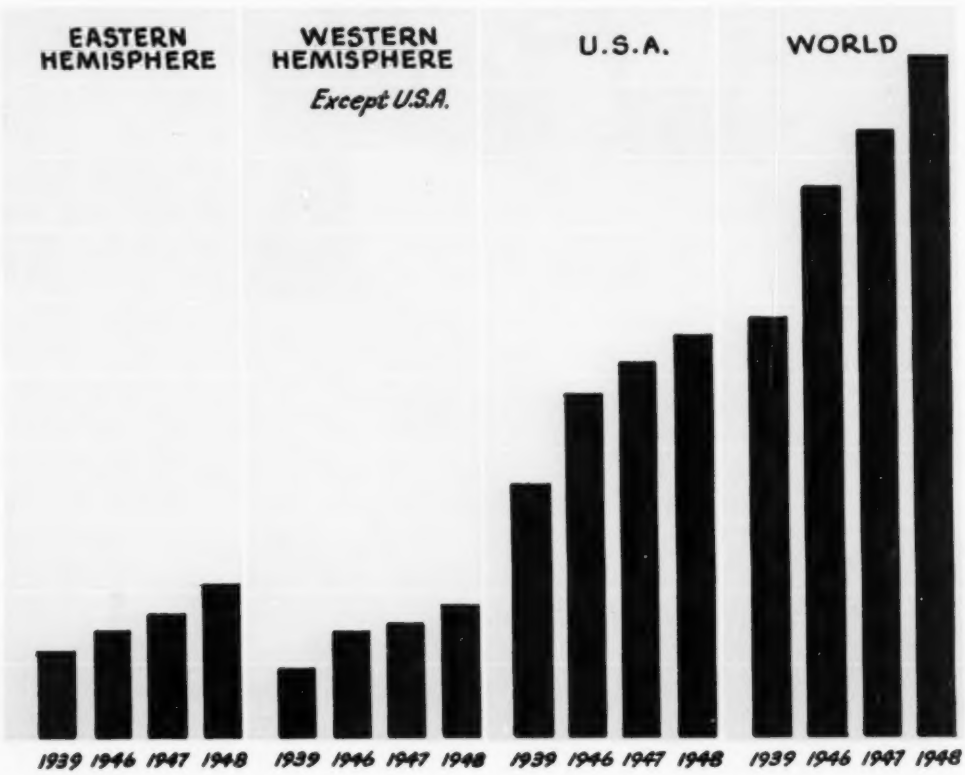


Chart showing growth of crude production in major geographical areas since the war and comparison with prewar production.

refinery to run Middle East Crude. The added investment at Philadelphia may rise to $100 million. Current capacity of the Philadelphia plant is 77,000 barrels daily and this will be increased at once to 107,000 barrels daily.

As the year closed, Saudi Arabian crude production was running at double the 1947 average. For the year as a whole, however, production averaged 390,000 barrels daily, an increase of 58.5 percent from the 246,000-barrel 1947 record. One important new field, Ain Dhar, was discovered in Saudi Arabia during the year but is not now being produced due to lack of pipeline outlet. At the year end 69 wells were producing more than 500,000 barrels of oil daily. At the end of 1947 there were 51 producing wells and 13 shut-in or observation wells not being produced.

WORLD CRUDE OIL PRODUCTION

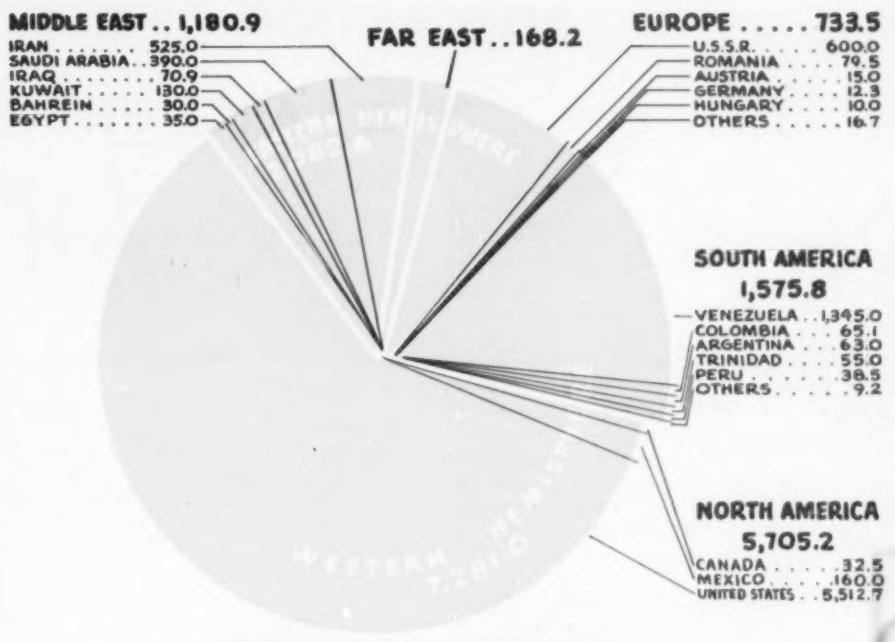
Thousands of Barrels Daily

	1939	1946	1947	1948
United States	3,465.7	4,749.1	5,085.2	5,512.7
Canada	19.1	20.6	21.2	32.5
Mexico	162.0	134.6	159.0	160.0
Total No. America	3,646.8	4,904.3	5,265.4	5,705.2
Venezuela	567.0	1,064.0	1,208.0	1,345.0
Colombia	65.5	61.5	67.0	65.1
Argentina	51.0	56.9	60.5	63.0
Trinidad	52.8	55.0	56.1	55.0
Peru	37.1	34.2	35.2	38.5
Ecuador	6.3	6.5	6.5	7.4
Bolivia	0.6	1.2	1.0	1.2
Cuba	0.3	0.6	0.6	.3
Brazil	—	0.2	0.2	.3
So. America & Carib.	780.6	1,280.1	1,435.1	1,575.8
Western Hemisphere	4,427.4	6,184.4	6,700.5	7,281.0
Iran	214.0	401.1	424.0	525.0
Saudi Arabia	10.8	165.2	246.0	390.0
Iraq	84.5	96.7	98.0	70.9
Kuwait	—	16.2	44.6	130.0
Bahrein	20.8	21.9	26.0	30.0
Egypt	12.8	24.5	25.6	35.0
Near & Middle East	342.9	725.6	864.2	1,180.9
Neth. East Indies	170.0	5.7	22.2	84.4
British Borneo	20.0	5.7	35.6	54.5
Sakhalin	11.0	16.0	16.0	16.0
India* & Burma	28.0	8.0	8.0	8.5
Japan	7.3	3.0	3.6	3.3
China	—	2.0	1.0	1.5
Far East	236.3	40.4	86.2	168.2
Romania	128.5	86.2	78.5	79.5
Austria	11.7	15.1	16.9	15.0
Germany	12.3	12.4	11.6	12.3
Hungary	3.0	14.1	12.0	10.0
Poland	10.7	2.6	2.6	2.7
Netherlands	—	1.2	4.0	9.3
Albania	2.5	1.0	1.5	1.0
France	1.4	1.1	1.0	1.1
United Kingdom	0.1	1.1	1.0	0.9
Czechoslovakia	0.2	0.5	0.6	0.4
Yugoslavia	—	0.1	1.0	1.1
Italy	0.2	0.1	0.2	0.2
Europe Ex U.S.S.R.	170.6	135.5	130.9	133.5
U.S.S.R.	592.0	451.0	525.0	600.0
Eastern Hemisphere	1,341.8	1,352.5	1,606.3	2,082.6
World Total	5,769.2	7,536.9	8,306.8	9,363.6

*Includes Pakistan; daily average 1948, 900 barrels.

Percent of World Crude Production

	1946	1947	1948
Principal Nations:			
United States	63.0	62.0	59.0
Venezuela	14.2	14.2	14.4
U.S.S.R.	5.8	6.2	6.7
Iran	5.3	5.1	5.6
Saudi Arabia	2.2	3.0	4.2
Western Hemisphere	82.0	81.0	77.8
North America	65.0	64.0	61.0
South America	17.0	17.0	16.8
Eastern Hemisphere	18.0	19.0	22.2
Middle East	9.7	10.3	12.6
Oceania & Far East	0.6	1.0	1.8
Europe	7.7	7.7	7.8


MIDDLE EAST . . 1,180.9
IRAN 525.0
SAUDI ARABIA . . 390.0
IRAQ 70.9
KUWAIT 130.0
BAHREIN 30.0
EGYPT 35.0
FAR EAST . . 168.2
EUROPE 733.5
U.S.S.R. 600.0
ROMANIA 79.5
AUSTRIA 15.0
GERMANY 12.3
HUNGARY 10.0
OTHERS 16.7
SOUTH AMERICA
1,575.8
VENEZUELA . . 1,345.0
COLOMBIA . . . 65.1
ARGENTINA . . . 63.0
TRINIDAD 55.0
PERU 38.5
OTHERS 9.2
NORTH AMERICA
5,705.2
CANADA 32.5
MEXICO 160.0
UNITED STATES . . 5,512.7

World crude production by nations and areas in 1948.

In 1949 production will be dependent partially on demand and partially on availability of transportation facilities. At the moment it is estimated that production will average around 550,000 to 575,000 barrels daily, an increase of 41 to 47 percent over 1948.

Largest producer in the Middle East still is Iran, which currently is producing about 550,000 barrels of crude daily and which averaged 525,000 barrels daily in 1948. This was an increase of 101,000 barrels daily average or 23.8 percent over the 1947 average of 424,000 barrels daily.

In 1949 production will be limited by refinery and transportation capacities, as is the case with other Middle Eastern areas. The 70-odd wells now being produced have ample capacity to yield a great deal more oil than they are currently being called on to provide. It is estimated that market outlet for the eight Iranian fields will be about eight million barrels greater in 1949. If this estimate proves to be correct, Iranian production will not greatly vary from its present level.

Production figures released by Soviet Russia currently are in terms of percentages of previous years rather than in barrels daily. In the first quarter of 1948 the U.S.S.R. reported an increase of 24 percent over 1947 and 43 percent over the same quarter in 1946. Second quarter production was 15 percent over 1947 and 36 percent over 1946. Latest available figures are for the third quarter, which was up nine percent over 1947 and 32 percent over 1946. On the basis of these announcements, it is calculated that production for the year 1948 was up about 14 percent over 1947 to 616,000 barrels daily in the U.S.S.R. proper, eastern Poland and Sakhalin. Under the present five-year plan Russia expects to produce 670,000 barrels daily in 1951. The nation already has built back to its prewar level, and it is anticipated that the program goal can be met without undue difficulty. Current goals are much more realistic than those set in two prewar five-year plans.

Outside of Russia the production of European fields showed little change in volume in 1948. Production in the Netherlands was more than doubled, but daily average volume for the year still was only 9,300 barrels daily.

Far Eastern fields and those in Oceania continued their rapid recovery from war destruction. Netherlands East Indies production rose 284 percent to 84,400 barrels daily average. While this is a fine recovery, it still is only half the production in the NEI in 1939. Many fields still are not open to prewar operators due to political disturbances.

British Borneo increased its production 53 percent in 1948 and became at the end of the year the largest producing area in the British Empire, wresting the lead from Trinidad. Average production in 1948 is estimated at 54,500 barrels daily compared with 35,600 barrels daily in 1947 and 20,000 barrels daily in 1939. In the first half of 1948 British Malayan Petroleum Co. Ltd., completed seven producing wells in Brunei and was running three rigs in that state and one in Sarawak. Production at that time was coming from 144 wells in Brunei, average output at midyear being 52,000 barrels daily. In Sarawak 80 wells were producing 970 barrels daily. It is anticipated that production in Brunei will continue to grow at a substantial rate in 1949. Local demand in Oceania is far in excess of supply.

INTEGRATION OF OPERATIONS IN A LARGE REFINERY*

By K. B. Ross[1] and D. N. McKinlay[2]

IN this paper the methods in use in Abadan for integrating the various operations which go to make the modern large refinery are described. This refinery, judged on the crude-oil capacity (namely 500,000 bd.), is believed to be the largest in the world. The problems in co-ordinating production of a variety of products on so large a scale will no doubt be of interest to other refiners.

The refinery is situated on the Shatt-al-Arab River some 40 miles from the head of the Persian Gulf. The major portion of the products are shipped over jetties arranged along the left-hand bank of the river. About 51 percent of the total products are distributed to local markets by pipeline, rail- and road-tank wagon, and river and coastal craft, the remainder being exported by tanker.

The crude oil as received in Abadan is a mixture of stabilized crude from the following fields:—Masjid-i-Suleiman, Lali, Haft Kel, Naft Safid, Gach Saran and Agha Jari. 500,000 bd. are required for distillation in the refinery, and in addition there is the quantity required for shipment to refineries abroad. Since the storage, pumping, and distillation of the crude oil within the refinery must be carefully controlled to tie in with the deliveries from the fields a close liaison is maintained between the producing areas and the refinery through a central source in the fields.

In addition, at the Masjid-i-Suleiman reservoir there are installed three topping units, the function of which is to allow an enrichment of distillate or fuel oil into the crude being dispatched from that area while the unwanted material is returned to the reservoir. At one time the function of these units was of greater significance than today, since the effect of one million gallons per day of residue or distillate, as the case may be, was quite considerable when the total refinery throughput was to the order of 6 or 7 million gallons per day (mgd.) of enriched crude; today, however, this effect is not so apparent, since the percentage effect on the daily throughput of 500,000 barrels is proportionately less. However, during the war and in subsequent years these units have provided a flexibility which has enabled the available tanker space to be used to the best purpose.

We have then before us a picture of continuous daily production of crude oil being pumped into Abadan from between 100 and 150 miles away. The crude oil is blended as required at a manifold at the entrance to the refinery and is picked up by pumps direct from the main suction lines, a boosting system maintaining the required suction pressure. Crude-oil storage tanks are located at this site and are connected to the pumping system, but the primary use of the tanks is to cater for emergency shut downs since a very large number of tanks would be required to provide an adequate reserve storage. The flexibility of the pipeline and communication systems makes it unnecessary to have large reserves of crude storage available. In addition, loss of light ends and the emission of gas from the crude is also largely avoided. By this system the use of crude oil of up to 10 lb. Reid vapor pressure is possible, which provides an easy method of bringing ethane and propane into the refinery for use as fuel.

After establishing uninterrupted crude-oil supplies to the refinery crude-oil feed system, the next most important factor in the integration of operations is ensuring that sufficient refining units in a good state of safety and repair are available to handle the required quantity of crude oil. This entails close liaison between the estimating, operational survey, and maintenance groups. Forward planning of throughputs must take into consideration estimated times required for overhaul units. The time between overhauls has been determined from data collected over a number of years, which has been correlated with existing inspection codes. The figures on pressure vessels have allowed a code to be drawn up which demands survey of pressure vessels once every 48 months. In cases of fouling of units these are not brought off service until definite evidence is available that the fouling has affected the quality of the products. By application of this code, time efficiencies are improved, resulting in more plant being available and less work being necessary by the labor force. Co-ordination of strength of labor force and work to be done is essential if high time efficiencies are to be maintained. This has only become possible in Abadan by accurate planning and progressing of all work done in overhauling units. By correct planning, emergencies, with the unplanned work associated with them, are reduced to a minimum.

Naturally the continuous pumping of the blended crude oil to the distillation units is a matter of extreme importance. The motor-driven crude-oil pumping sets, each of two mgd. (56,600 bd.) capacity, total 20 mgd. capacity overall and are housed in three separate pumphouses, each located at a safe distance from the other to provide dispersal in case of fire. The crude-oil pumping system can therefore be regarded as safe from being completely shut down except in the case of a general power failure.

While in general it may be said that forward market demands dictate the programing of the throughput of a refinery, in actual practice today the world demand is for maximum production of petroleum products, and it is principally availability of refinery capacity which sets the throughput of a refinery from month to month. The major products required for marketing are: aviation spirits, motor spirits, special boiling spirits, kerosines, vaporizing oils, gas oils, marine diesel oils, fuel oils and bitumen.

The distillation capacity down to atmospheric residue consists of four large units of 3 mgd. (85,000 bd.) capacity and five units of approximately 1 mgd. (28,300 bd.). The original pipestill units in the refinery were of 1 mgd., but in 1936 the first 3 mgd. unit was commissioned.

With further increases of throughput all in 3 mgd. steps the loss in throughput caused by overhauling one of the large units has become less marked. With further reductions in overhaul time due to increased planning and revised inspection codes, the effect of the loss of one large unit on total throughput will be correspondingly less. The units are fully instrumented and therefore call for low operating manpower.

In order to obtain the various final products indicated above the units are operated to give the following actual fractions: gas at 60 psi., primary flash distillate containing hydrocarbons in the C_3 to C_6 range, *iso*heptane base containing mainly C_7 hydrocarbons, straight-run benzine, naphtha reforming cut, aromatic cut for solvent extraction, unrefined kerosine for burning oil and vaporizing oil, gas oils and atmospheric residue.

The atmospheric residue undergoes further distillation using ancillary heaters and vacuum columns to provide gas oil, waxy distillates, and bitumen.

All these products are not simultaneously derived

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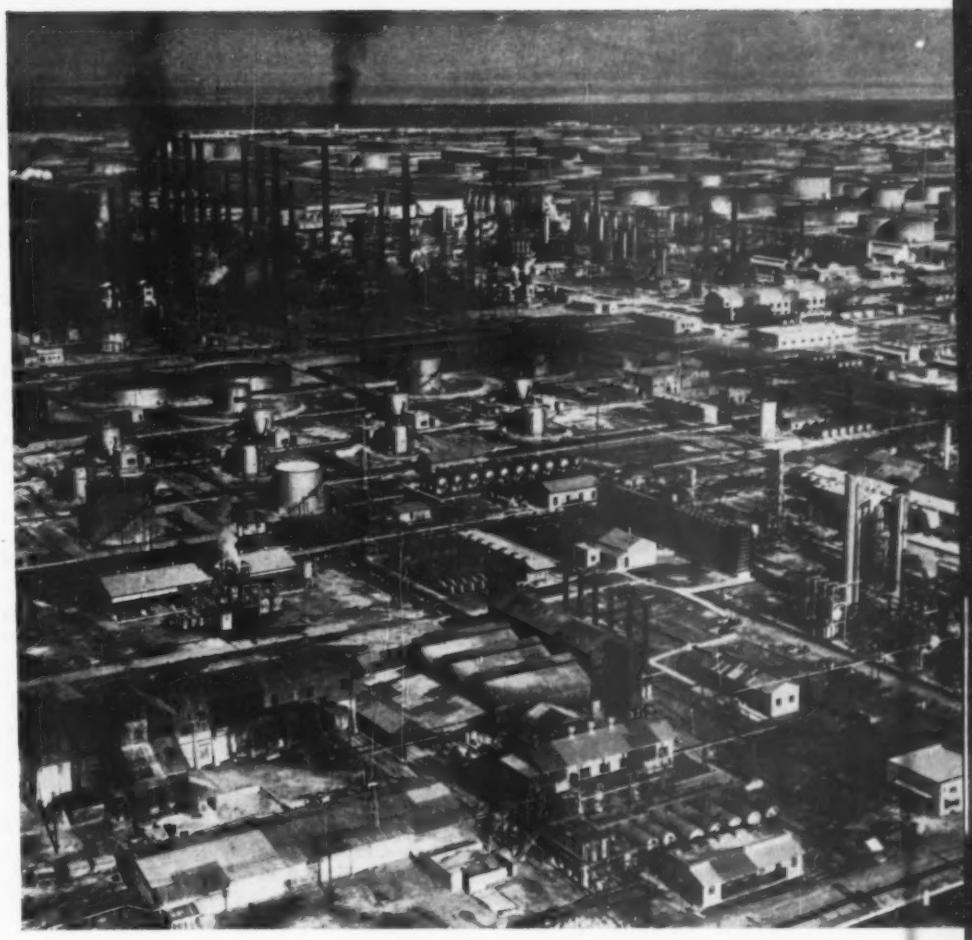
from one individual unit, but rather from the combined output of several such units, one perhaps producing *iso*heptane base from the atmospheric column overhead, while another unit will provide from its atmospheric column overhead the required straight-run benzine. In the same way aromatic cut for solvent extraction for aviation-spirit manufacture may be produced on one distillation unit while a companion unit may, from a similar side stream, produce a virgin reforming stock.

The amount of gas liberated on distillation of 17.5 mgd. crude oil is some 18 million cu. ft. per day. Recovery of butanes and gasoline from the gas is practised, the residual gas being used for the recovery of sulfur after which it is blended into the refinery fuel-gas system. An adequate venting system to atmosphere is provided for emergencies.

In the production of aviation spirits the primary flash distillate, which is obtained as the overhead condensate from the primary distillation (column-base pressure is 70 psi.), is passed forward to a series of fractionating columns. The first operation is carried out using high-pressure columns where propane and lighter hydrocarbons are liberated under controlled conditions to join with the gas from the primary flash equipment for H_2S recovery and subsequent use as fuel. The maintenance of continuity of operation at this point is vital, since a shut down here would disorganize and eventually shut down the whole of the distillation process; standby capacity is essential.

The depropanized gasoline contains some 25 per cent of butanes. These mixed butanes are recovered in a succeeding distillation and passed forward via a mercaptan-removal unit to the alkylation process for the recovery of *iso*butane which amount to some 20 per cent. The *normal* butane provides feedstock for the isomerization process. The provision of C_4 (about 300,000 gpd.) is the first link in the chain between crude oil and aviation-spirit production. The integration of operations whereby depropanization, debutanization, and de-*iso*pentanization are carried out in successive columns is very close and must be maintained. If the butane fractionation is lost, an escape route for the undebutanized gasoline into straight-run benzine is available, but it has its effect in shutting down plant in the back end of the aviation chain. Upon debutanization of the primary flash gasoline the product is quite stable at about 10 to 12-lb. Reid vapor pressure and suitable, after treatment, for inclusion in motor spirits, but all the *iso*pentane in the crude oil is concentrated in this residual fraction.

Since *iso*pentane is included as a blending component in aviation spirit it becomes necessary for a certain proportion of this debutanized gasoline to be fractionated to provide the required amount of *iso*pentane. The quantity required is some 140,000 gpd. It is obvious, therefore, that another link between crude oil and aviation spirit exists here and the operation of depropanization and debutanization must proceed before *iso*pentane can be made available for aviation spirits.



The Washery area of the Abadan Refinery.

It may be remarked here that the storage for depropanized gasoline and for debutanized gasoline is practically negligible, consisting merely of balance tanks which give little more than an hour's total storage, and therefore any emergency must be taken up by provision of the necessary spare capacity. Continuity of production is therefore essential and it is obvious that behind this part of the process the treatment units must be in a position to be able to deal with the product. Failure to produce butane and *iso*pentane will not shut down the refinery, but will slow down production of aviation spirits.

After the removal of *iso*pentane the balance of gasoline is split up. A portion, depending upon the market demands, is bled off for mercaptan removal and then included in motor spirits. The remainder is passed forward to storage tanks from which it is pumped to fractionating columns for the removal of some 200,000 gpd. of *iso*hexane concentrate.

The *iso*hexane base storage capacity is comparatively large and therefore a certain amount of latitude is possible in the integration of the passing forward of the base stock and the production of the *iso*hexane. However, loss of time can generally be ill afforded and an inordinate loss of time in the segregation process would result in having to turn away base stock which would mean a direct loss to production. By "topping" and "tailing" the *iso*hexane base a product is obtained which, after acid treatment and re-running for removal of sulfur, is used as a blending agent for 100-octane aviation spirit. The discarded materials are blended into naphtha-reforming stock.

So far we have dealt with the products of the primary distillation of the crude oil. Let us now consider the fractions in order of volatility as they are distilled from the crude oil under atmospheric pressure. First, we have the overhead product from the various atmospheric columns. This material contains most of the *iso*heptane available in the crude oil and most of it is used to provide an *iso*heptane-bearing base feedstock while the balance may be used, after sweetening, as a straight-run benzine in the blending of motor spirits.

Taking the *iso*heptane base first, this material is pumped to base feed tanks which provide a

limited amount of storage. It is then fractionated in a series of 100- and 50-plate columns, the "tops" providing an additional base feedstock for *iso*hexane; the bottoms are blended with naphtha-reforming stock. The middle cut, some 250,000 gpd., is the *iso*heptane which, after treatment with 98 percent H_2SO_4 and subsequent redistillation for removal of sulfur, is blended in 100/130 grade aviation spirit.

The remainder of the atmospheric column overhead product is refined to low-mercaptan-sulfur content and, along with cracked spirit, is used in blending motor spirits.

The first side stream from the atmospheric column is usually a product of about 0.760 sp. gr. containing about 20 percent of aromatics which can be extracted with liquid SO_2 in an Edeleanu type plant. The extract, after sulfur removal, has a fairly high octane number and a high rich-mixture number. Manufacture of this product demands: (1) a continuous distillation of crude oil to provide the daily amount of feedstock, (2) the liquid SO_2 extraction of some 700,000 gpd. of base. (3) acid treatment in a counter-current type of washery, (4) continuous operation of a redistillation unit to remove sulfur down to a figure as low as 0.003 percent. All these operations employ small intermediate tanks as buffer-storage vessels, but the combined storage is quite limited, and the necessity to maintain continuous production is paramount.

Since the total amount of this particular fraction of the crude oil is more than that required for aviation-spirit base stock, the balance is continuously passed forward to mix with the discards from the *iso*heptane and *iso*hexane distillations and the raffinate from the SO_2-extraction plant to provide the required amount of reformer feedstock.

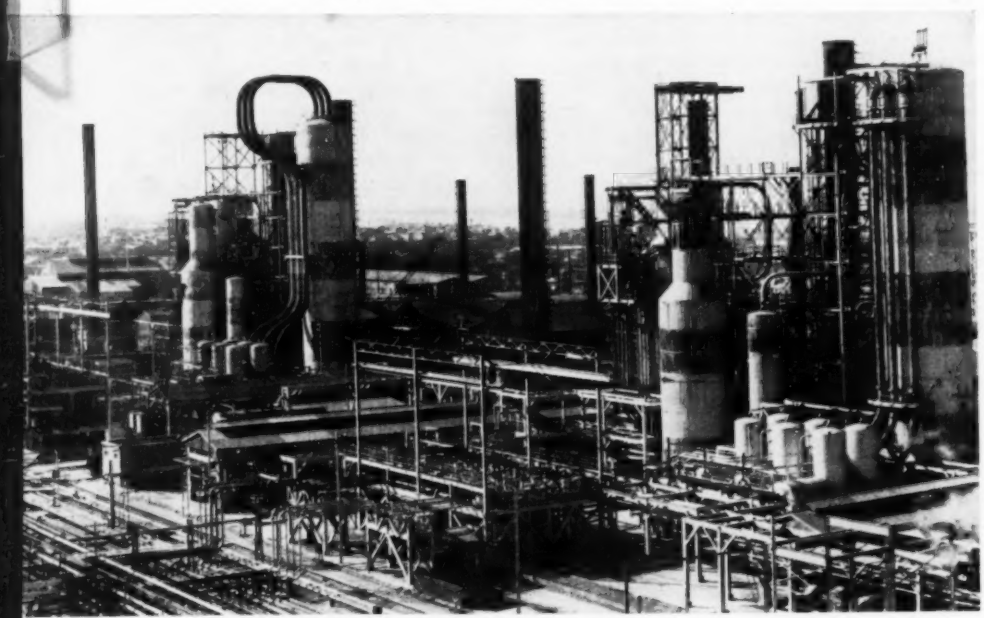
Prior to the production of aviation spirit in Abadan the use of reforming was confined mainly to the upgrading of naphtha for the production of high-octane motor spirits. The position has now changed and, within limits, it may be said that the primary purpose of reforming in Abadan is the production of butenes for the alkylation process. The cracked spirit produced from the reforming units is leaded and therefore need not be of high quality.

The amount of unsaturated C_4 which is derived from the reforming units controls the daily production of butene alkylate. Associated with the cracked spirit derived from reforming there is a pentene cut which can be fractionated out of the spirit and alkylated with *iso*butane to provide pentene alkylate. It is therefore most essential that the required reforming throughput is made available and that the complete utilization of the butenes and pentenes is accomplished by having the alkylation units available to deal with the unsaturates. With a high aviation spirit demand it is essential that alkylation capacity should not be idle for want of feedstocks. This illustrates the necessity for efficient planning to co-ordinate the operation and overhaul of reformers and alkylation units.

The manufacture of aviation spirits, both 91/98 and 100/130 grades, demands the production of *iso*pentane, *iso*hexane, *iso*heptane, benzine extract, and alkylate. We have shown the place of each component in its separate manufacture system and its relation to the preceding and subsequent operations. A smooth integration of planning, operation, subsequent treatment, and blending is necessary if optimum production is to be achieved.

Before leaving the manufacture of aviation-spirit components an indication of the equipment in use will give an additional idea of the extent of the operations and the need for careful planning of the interdependence of units.

Modern distillation units, Abadan.



Alkylation capacity, consisting of three separate units, is 350,000 gpd. or 10,000 bd. Associated with each alkylation unit is an isomerization unit, each of capacity 70,000 gpd. (2,000 barrel) of net *iso*butane. Two anhydrous hydrochloric-acid-manufacturing plants provide the HCl for activating the aluminum-chloride catalyst in the isomerization process.

*Iso*hexane production is carried out using 1×50 plate and 2×76 plate columns. The *iso*heptane fractionators are 2×100 plate columns for the first operation, or topping process, and 2×50 plate columns for the second operation, that is removal of the *iso*heptane overhead.

A 700,000-gpd. (20,000 bd.) SO_2-extraction unit provides the benzine extract of aromatics; associated with this unit there is an SO_2-production until producing more than two tons sulfur dioxide per day.

Sulfuric acid for the alkylation process is manufactured in an adjacent area. Here there is also situated a plant for recovery of sulfuric acid by the destruction of sulfuric-acid sludges.

Electric power is supplied from the main power station. Water cooling is provided by three cooling towers in the area, each with a capacity equivalent to 2 million gallons per hour (mghr.), The steam requirements are met from the area boiler battery with a maximum continuous rating of some 1,600,000 lb per hour. The planning of the overhauls of the utilities in the general scheme is also, therefore, a very vital necessity.

The manufacture of motor spirit today shows a marked difference from production prior to the war. This change has been brought about to a great degree as a result of the impingement of aviation-spirit production on the refinery manufacturing program. . . .

The pre-war manufacture of motor spirits was comparatively simple; the production depended greatly upon the throughput of the reforming units. Today, with a balance struck between the production of aviation spirit and motor spirit, the emphasis is on the production of the unsaturated butenes and pentenes necessary for alkylation production as described above, *i.e.* there is a prerequisite of maintaining a steady production of aviation spirits. The amount of cracked spirit derived from the reforming of naphtha does not constitute the main criterion of motor-spirit production, since the general tendency to utilize TEL. to increase the anti-knock properties of motor spirits has led to the present-day motor spirit requiring a lower octane-rating base stock. In other words, for the same amount of reforming capacity it is possible today to increase crude-oil-distillation capacity and absorb the extra straight-run distillate, within limits of volatility and final boiling point, to make an increased amount of benzine mainly because of the use of

TEL. to raise the octane number of the straight-run benzine and make it a suitable motor-spirit blending agent. The limiting factor finally is the maximum permissible dosage of TEL. for particular motor spirits as set by the marketing organization.

It can be seen therefore that a large measure of flexibility is available to the refiner integrating the needs of motor-spirit and aviation-spirit production plants. When on full crude-oil throughput it is possible to produce in Abadan some 2.8 mgd. (80,000 bd.) of reforming stock and, 1.65 mgd. (47,000 bd.) of straight-run benzine. In the event of the treating plants for the straight-run benzine breaking down and thereby limiting flexibility to deal with the continuous treatment of the daily production of straight-run distillate, it is possible to swing the extra material into the reforming stock for which there is fairly large storage capacity. Likewise, should the reforming capacity be temporarily reduced, it is possible to maintain full crude throughput by transferring the surplus reformer stock to the straight-run benzine fraction or temporarily to include the heavier portion in the kerosine streams.

In Adadan today the ordinary grade of motor spirit is made by blending straight-run benzine, gasoline, and cracked spirit which has been corrected for vapor pressure by injection of the required amount of butane. The proportions of the components with their known lead responses will determine how much TEL. is required to give the required octane number and the other characteristics such as front-end volatility, 90 per cent point, vapor pressure, and FBP.

The above describes the manufacture of ordinary grade of pool spirit. High octane-number premium-grade motor fuels can be easily manufactured today by utilizing part of the high-grade components at present used in the manufacture of aviation spirit. Much depends upon the market demands as to the amount of the various motor and aviation fuel production, but it is obvious from the above that a great flexibility can exist in the range of octane numbers of motor spirits without operating extra plant.

The reforming of naphtha is limited to the minimum required for the necessary production of butenes, provided that the resultant cracked spirit is sufficient in combination with the maximum permissible TEL. dosage to blend off all the straight-run motor-spirit blending fractions. The pressure distillate derived from the reformers is stabilized to remove propane—propylene, which is used as refinery fuel, and the depropanized material is further processed in order to make available the butane—butene for alkylation. Acid treatment, redistillation, and final sweetening all follow in sequence as continuous operations. The programing of overhauls for acid-treatment plants and redistillation units must be carefully linked up with all the other refinery operations or once again the failure of a remotely removed process could have serious repercussions on the general refinery program. Spare treatment capacity is available to allow for overhauls being scheduled without interrupting the general flow.

At one time the amount of kerosine manufactured played an integral part in the production of high-grade motor spirit, since the aromatic extract produced in the SO_2-solvent extraction plants had, after redistillation and refining, a high octane number, and part of it was used in the production of high-octane motor spirit. Any breakdown in part of the kerosine treatment facilities had its repercussions on high-grade motor-spirit production.

The atmospheric distillation products so far dealt with have been *iso*heptane-bearing base, straight-run benzine, and the cut required for extraction of aromatics in the C_6 range. The next product in order of boiling range is the unrefined kerosine, which is derived generally from the second side stream of these columns. All the similar boiling fractions in the kerosine range are collected and pumped along a transfer main to balance storage as unrefined kerosine. This material is treated by means of sodium plumbite to doctor negativity. The plumbite treatment units, three in number, are each capable of handling 0.5 mgd., *i.e.*, a total of 1.5 mgd. or 42,000 bd.

The semi-refined product is then passed via balance storage through bauxite driers to remove water so that the kerosine may enter the SO_2 extraction plants and contact the SO_2 relatively free of water in order to reduce corrosion to a minimum.

The extract containing the undesirable sulfur and aromatic materials amounts to some 15 per cent and is removed continuously. The "extract" is redistilled and various "cuts" are taken off which have high-octane value because of the high aromatic content. A large portion of this was at one time used for the production of high-octane motor-spirit, but today the bulk of the extract distillate is utilized in the manufacture of tractor vaporizing oil. The refined kerosine amounts to 85 per cent by volume, *i.e.*, some 1.27 mgd. or 35,000 bd., and is pumped away immediately to final storage for shipment.

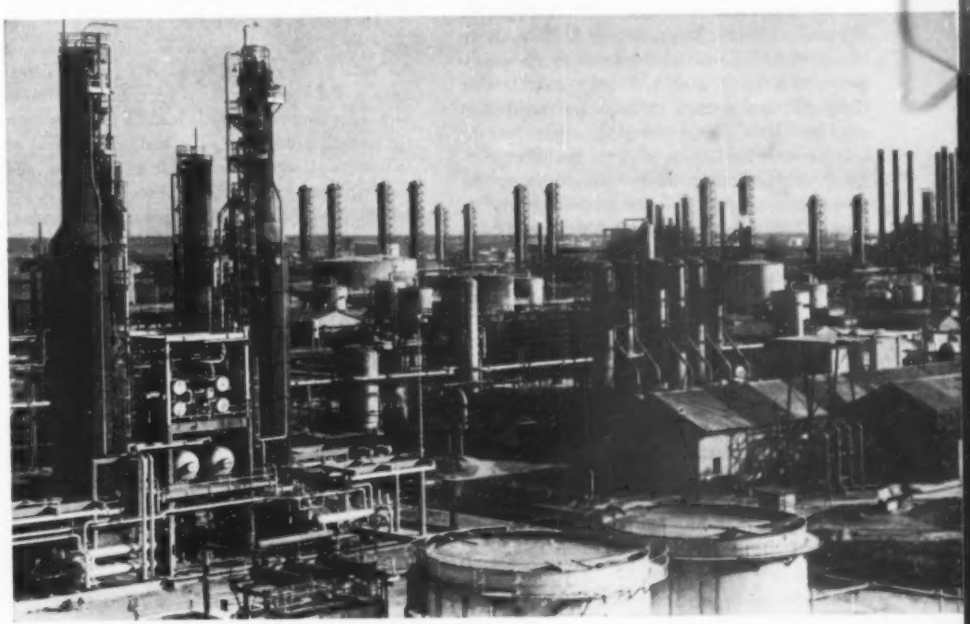
With the increase in kerosine-treatment capacity it has been possible to increase the production of tractor vaporizing oil in Abadan refinery. The method of manufacture is to blend the aromatic cut derived from the distillation of SO_2 extract from kerosine along with raw kerosine of diverse boiling ranges. The blend is treated with sulfuric acid in order to reduce the sulfur content. This blend of acid-treated kerosines and aromatic is mixed with a portion of heavy cracked spirit to give the required octane number, distillation range, specific gravity, and low sulfur content necessary for the tractor engine.

From the above we see how the manufacture of kerosine for burning oil becomes involved with the blending and production of tractor vaporizing oil and how both must link in with the operation of the redistillation unit and the acid-treatment facilities to give final products of kerosine, high-grade motor spirits, and tractor vaporizing oil.

To cover for shut downs in the subsequent redistillation and acid-treatment units fairly large intermediate tankage for storage of extracts exists, but in general it may be said that the process is continuous and completely integrated with the rest of the operations in the refinery.

A fair degree of flexibility exists here. Gas oil for high-speed diesel engines requires no treatment and is withdrawn continuously from the distillation unit and pumped to storage in the

General view of the Special Products Area of the Abadan Refinery. This area was developed during the war for the production of high-octane motor fuel.



tank farm. Production is of the order of 1.5 mgd.

Special gas oils having, in particular, lower pour points which are desirable in cold climates are produced by blending with other fractions which results in a final product with the required pour point. This is purely a matter of blending.

The residue which is withdrawn from the atmospheric columns is some 50 percent of the throughput, *i.e.*, it is some 8.75 mgd. or 250,000 bd. This material is suitable as a fuel oil, but as it contains valuable gas oil part of it is subjected to vacuum distillation. Vacuum-distillation capacity (some 2.5 mgd. or 71,000 bd.) exists for processing atmospheric residue, and from it are produced extra gas oil as an overhead product, waxy distillate as a side-stream product, and bitumen from the column base. The vacuum gas oil is much heavier than atmospheric gas oil and can be blended with kerosine and atmospheric residue to give the various grades of heavy diesel oils.

The waxy distillates are blended in with the residual bitumen, the balance of atmospheric residue and cracked gas oil and residue derived from the reforming of naphtha to provide the various grades of fuel oils according to the viscosities and pour points which are the main criteria.

For some time white oils and middle distillates have been in such large demand that, in spite of enriching the crude oil with distillate at the fields by operating the topping plants and discarding the residue, there has at times been a surplus production of fuel oil. It has therefore been necessary to utilize the ultimate flexibility factor, namely the re-cycling of surplus fuel oil to the wells, since fuel-oil-storage tankage has been kept full.

Intimately connected with the operation of the vacuum units is the production of base stocks for the various grades of bitumen. Towards attaining the maximum production it is desirable to charge the air rectification stills with the appropriate base stock, and it is quite possible that three different vacuum columns are required to produce the different charging stocks for the simultaneous production of three grades of bitumen. A close link exists, therefore, between the air-rectification stills and the vacuum-distillation units. The supply of solvents for cut-back-bitumen production depends on the side streams being produced from individual distillation units and the continuity of operation unless cut-back-solvent storage is available.

On the other hand, closely integrated with the bitumen-production program is the supply of drums for packaging the various grades, and the drum-manufacturing plant program must tie in exactly with the bitumen blowing and blending schedule. It is more than likely that simultaneous production of drums for solid and cut-back bitumen is required.

Among the products not mentioned hitherto are special-boiling-point spirits, including mineral turpentine. The manufacture of mineral turpentine, or white spirit, is an integrated process of distillation of the required fraction on crude oil, its treatment, and subsequent redistillation. White spirit is not listed among the major products, and there is no need to expand on the part it plays in the refinery program as a whole although, since it occupies equipment used for other products, its place in the manufacturing program must be set. As regards special-boiling-point products, since these are generally cuts of particular boiling ranges derived from particular refined products their manufacture is not closely linked with the general refinery program.

Likewise the manufacture of such special petroleum chemicals as di*iso*butylene, *cyclo*hexane, toluene, ethyl benzene, and paraxylene requires special arrangements since specialist equipment may be required and it must tie in with the ordinary refinery program. The manufacture of di*iso*butylene, if it is not to interfere with the maximum production of alkylate, requires an increased reforming of naphtha in order to provide the extra unsaturated C_4 for polymerization. This carried out in a special plant, and the material after debutanization and redistillation, is dispatched for shipment.

*Cyclo*hexane to a great extent disrupts aviation-spirit production in that the required fraction has to be abstracted by superfractionation from *iso*-heptane, and there the equipment used for the processing of *iso*heptane has to be given over for this particular operation. The production of *cyclo*hexane is not closely linked with refinery operations other than the required production of aviation spirit to meet the necessary market demands. Much the same can be said concerning the manufacture of toluene, ethyl benzene, and the xylenes.

In the final analysis the throughput of the refinery and the production of the individual grades must be controlled according to a set program of offtake. The storage capacity available for each grade of product plays a part in determining the throughputs to be run. The tank-farm receiving storage, and loading facilities must tie in with production rates and with arrival of tankers, and should be capable of receiving and loading some two million tons of products per month. The optimum stock holding of individual products is a matter for close liaison between the marketing organization side on the one hand and the refinery production side on the other, since acute embarrassment can ensue in the event of failure to offtake the products as foreshadowed. For instance, after employing the necessary available flexibility factors it may still be necessary to cut the refinery throughput because of congestion of one particular grade of oil. On the other hand, if offtakes are allowed to increase to such an extent that stocks of the various products are reduced to minimum levels, equal embarrassment may ensue since the production of grades of oil on such high throughputs requires time for testing and checking to ensure that nothing but satisfactory materials are delivered for shipment.

Associated with the treatment of white oils is the contacting with heavy chemicals, the manufacture of which is carried out in Abadan to tie in with the refinery production program. For instance, some 800 tons of caustic soda per month is made up into soda solution. As the manufacture of sodium plumbite for doctor sweetening must be arranged to tie in with the treatment of kerosines and straight-run benzines. In the same way the operation of producing bleach solution by leaching imported calcium hypochlorite must proceed continuously, since this chemical is also used in final sweetening processes.

The production of sulfur from the gases in the fields area is carried on continuously, as it is in Abadan utilizing H_2S-bearing refinery gases. These processes, along with acid-recovery plants, make Abadan practically self-supporting as regards supplies of sulfur. The sulfur is used in the manufacture of sulfuric acid using modern contact plants employing vanadium-oxide catalyst, the capacity of these plants totalling some 300 tons per day. Sulfur consumption is of the order of 2000 tons per month.

Liquid-SO_2-manufacturing capacity of the order of 14 tons per day is also available to supply SO_2 for the solvent-extraction processes. Although storage exists for sulfuric acid, liquid SO_2, and other chemicals, it is quite obvious that continuous production to tie in with the refinery program must be guaranteed.

Since the Abadan Refinery is so far from other industrial areas with a background of technical organization and assistance, adequate engineering stores for carrying spare parts must be available, and workshops must operate at a high pitch of perfection in order that all these manifold refinery operations can be interlinked without major breakdowns in order to ensure continuity of production.

The Abadan power station which has a generating capacity of some 80,000 kw supplies power to the refinery and the housing estates of both staff and labor. Steam is supplied to both generating sets, process plants, and water-pumping units by three boiler batteries with an installed capacity of approximately 4½ million lb per hour. This capacity allows adequate standby for cleaning and overhauling boilers and auxiliaries.

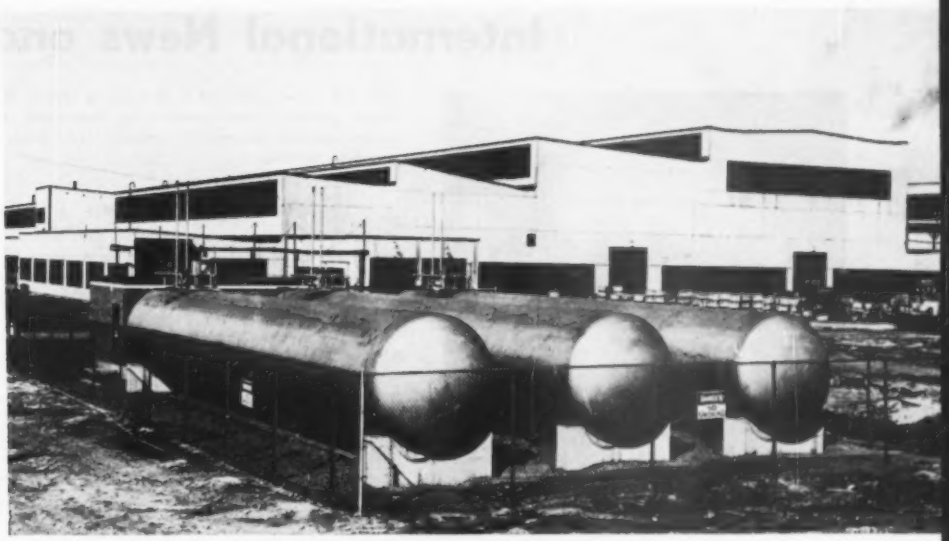
The refinery water supply is pumped from the Shatt-el-Arab river and is further augmented by four water-cooling towers giving a total water pumping capacity somewhat in excess of 25 million gphr. The power station has a segregated water supply which is cross-connected on to the main water system.

Compressed air at 100 psi. is supplied by centrally located turbo-compressors. This supply is mainly available for driving pneumatic tools. Lower pressure supplies of air are available for manufacture of blown grades of bitumen.

The authors wish to express their thanks to the chairman and directors of the Anglo-Iranian Oil Company Ltd. for permission to publish this paper.

K. W. Rugh, manager Philgas division, sales department, Phillips Petroleum Co.

E. O. Mattocks, technical representative, chemical enginering department.



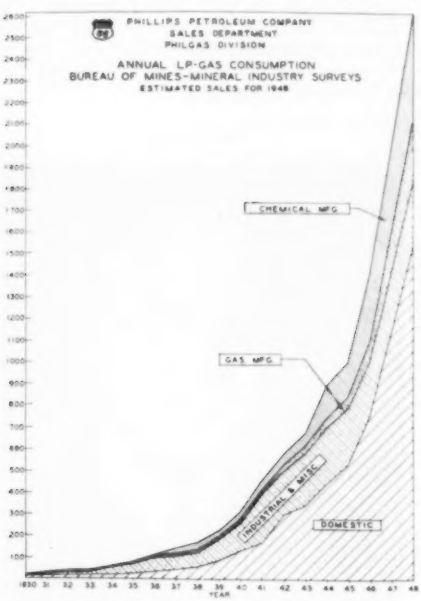
Typical LP-Gas installation at an industrial plant.

LP-GAS SALES RISE 29.5 PERCENT IN 1948

By K. W. Rugh and E. O. Mattocks

DURING 1948 the liquefied petroleum gas industry continued the steady growth which it has consistently shown during the past decade. It is estimated that during 1948 the total volume of liquefied petroleum gas marketed will reach a total of 2,600,000,000 gallons. This represents a 29.5 percent increase over 1947.

Estimated LP-Gas Sales, millions of gallons yearly.



The increase was greater than the total quantity of liquefied petroleum gas marketed during 1942.

The estimated volume of LP-Gas sold for domestic purposes in 1948 is 1,540,000,000 gallons, an increase of 33.9 percent over 1947. The total quantity consumed for domestic purposes in 1948 is greater than the total quantity of LP-Gas sold for all purposes in 1946, just two years prior. It is estimated that more than 25 percent of the gas ranges produced in 1948 went into the LP-Gas market. There are now about 5.5 million homes using LP-Gas, of which one-third use it for space heating as well as for the other household purposes. There are presently installed more than 3,000 bulk plants which is about equal to the number of counties in the United States.

Industrial and miscellaneous uses during 1948 are estimated at 280,000,000 gallons. One of the most rapidly growing uses for LP-Gas by industrial plants is for standby to other fuels, generally manufactured or natural gas. The use of LP-Gas in gas manufacturing continues its rapid increase. It is estimated that 280,000,000 gallons were used in 1948 for this purpose. This is an increase of 65.4 percent over 1947. A controlled amount of LP-Gas and air may be mixed directly with manufactured gas without encountering burner operating difficulties, but the reforming of LP-Gas to produce a substitute gas is permitting even greater quantities to be used.

LP-Gas is used generally not only to feed the reforming units but also to enrich the produced gas to the desired heating value. Large proportions of LP-Gas and air mixtures may be mixed with natural gas or in some instances may replace natural gas completely wtihout causing any unusual burner operating difficulties. Almost 400 towns are now serviced with LP-Gas exclusively.

The volume of LP-Gas used for chemical manufacture is one of the most difficult to estimate. LP-Gas is used as an intermediate product which is processed to some other product, the latter serving as an ingredient of a required chemical. Large quantities of LP-Gases in the gaseous form are furnished to chemical companies through pipe lines directly from the source of production. In a number of cases these gases are composed largely of olefins—unsaturated hydrocarbons. It is estimated that 500,000,000 gallons will be used in 1948 for chemical manufacturing purposes. This represents an increase of 20.7 percent over 1947.

During 1948 great results have been accomplished in increasing the storage capacity at consumers' installations. The industry has found this to be essential in order to provide gas for house heating during peak demands when requirements exceed production. Transportation facilities by pipelines, tank car and transports have been increased.

New sources of production of liquefied petroleum gas together with the enlargement of existing producing facilities have increased the supply of LP-Gas during the past year to keep pace with the increase in demand.

International News and Notes

Photo courtesy Shell Photographic Library
B. T. W. van Hasselt

King's Medal for Shell Managing Director

B. T. W. van Hasselt, a managing director of the Royal Dutch-Shell Group of Companies, recently visited London to receive the King's Medal at the hands of Hugh Gaitskell, minister of fuel and power. The award, introduced since 1945 for service in the cause of freedom, was made in recognition of Mr. Van Hasselt's work during the war when he was in charge of Shell's Venezuelan oil production which was vital to the Allied war effort. Mr. van Hasselt began his association with Shell at The Hague in 1920. He also served his company in Mexico, the Netherlands East Indies and London.

O. W. Bond Retires

Orlo W. Bond, manager of the New Delhi branch office of Standard-Vacuum Oil Company's India division, retired Jan. 1, 1949, after 27 years' service in India. During the war he supervised delivery of petroleum products to the Allied military forces in the China-Burma-India theatre and worked closely with the petroleum supply offices of the Air Transport Command and the U. S. Navy.

Venezuelan Production

Production of crude oil in Venezuela during the month of October amounted to 42,867,955 barrels, an average of 1,382,837 barrels daily or approximately the same as in September. Production by companies is shown in the following table:

Company			Total
Creole	15,158,839	4,979,609	20,138,448
Mene Grande	1,782,905	4,971,409	6,754,314
Shell	13,432,588	—	13,432,588
Sinclair	—	533,708	533,708
Socony	—	956,714	956,714
Texas	—	280,554	280,554
S.A.P. Las Mercedes	—	349,731	349,731
B.C.O.	40,904	—	40,904
Orinoco	8,081	—	8,081
Phillips	—	57,647	57,647
Rexco	62,270	—	62,270
Atlantic	—	252,996	252,996
Total barrels	30,485,587	12,382,368	42,867,955

E. H. WALKER, general manager of Shell Oil Company's personnel and industrial relations organization, has been appointed a vice president. Mr. Walker joined Shell in 1932 as a counterman in the storehouse at the firm's Norco, La., refinery. Following service in a wide range of positions in the engineering department and in various operating departments at Norco, he was transferred to St. Louis in 1936 as personnel assistant in the manufacturing department. He became general manager of personnel and industrial relations in 1943.

Refinery for Antwerp

Reports from Belgium state that plans have been completed for the erection of a refinery at Antwerp with an annual capacity of 1,300,000 tons. Capital for the project, which is estimated at approximately $3,000,000, is to be jointly provided by Belgian and British interests. Completion of the plant is set for 1952.

DR. PEDRO IGNACIO AGUERREVERE became Minister of Development in Venezuela's new cabinet which was appointed by the Military Junta immediately following the coup last November. That the choice was apt is obvious in view of Dr. Aguerrevere's background and record which show him to be a highly trained technician, a hard and experienced worker and a devoted servant to his government.

Dr. Pedro Ignacio Aguerrevere

He was born 52 years ago in Caracas where he received his early training. At the Central University he learned surveying and civil engineering; and at Leland Stanford University he majored in geology, obtaining the B.A. degree in 1921. It is interesting to note that although Dr. Aguerrevere had to learn English first, yet he managed to graduate with Phi Beta Kappa honors. In Colorado School of Mines he pursued post graduate studies, obtaining the M.S. degree in geophysics with petroleum production as a minor study.

Dr. Aguerrevere's years of study were interrupted by jobs that gave significance to his training. As early as 1913 and during the three years following, he was surveyor for the Caribbean Petroleum Company of Venezuela. In 1919 he went to Mexico to be assistant geologist for a subsidiary of Cities Service Company, and during most of the interval from 1921-1934 he was doing geological work in Venezuela, Colombia, Mexico, the United States, Germany and Romania for subsidiaries of this same company. From 1934-1936 he engaged in private practice in Caracas as consulting geologist.

Since 1936 he has been connected with the Venezuelan government. From that year until 1942 Dr. Aguerrevere served as geologist for the Venezuelan Ministry of Public Works, with emphasis on ground water problems. From 1942-1944 he was president of the Transport Commission; in 1944 he became president of the Food Commission; and from Dec. 1944 to April 1948 he was financial advisor in the United States for the Venezuelan Embassy. At the conclusion of this mission, Dr. Aguerrevere returned to Venezuela and was made advisor to the Ministry of Public Works in regard to the deepening of the Maracaibo Lake channel which at present admits only vessels of shallow draft.

Included in Dr. Aguerrevere's active career are several honorary assignments. In 1939 he represented Venezuela in the seventh assembly of the International Association of Geodesy and Geophysics, held in Washington; and in 1947 he attended the International Monetary Conference.

In commenting on Venezuela's future oil policy, Dr. Aguerrevere stated that the country has never had a truly national policy. Although those who have occupied this post have been men of high intelligence and exceptional ability, they have always introduced their own particular policies but have not set up a procedure that would be carried on by succeeding governments. Dr. Aguerrevere stated that it is his intention to set up an organization that will carry out a long-range program which will be fair and beneficial both to Venezuela and to private investors in the oil and mineral industries. As yet no further details are available, but the minister said he could give his personal assurance that all problems will be studied carefully in an atmosphere of good will and understanding.

Oil Manager's Award

A man who played a big part in helping the Allies on oil matters in Italy during the war is Arnold Hofland, now Shell's general manager in Germany, who was presented recently with the order of the British Empire (Civil Division) by Hugh Gaitskell, minister of fuel and power.

As civilian oil adviser to the Allies, Mr. Hofland accompanied the first Allied troops to enter Rome, where he uncovered a report which proved of great value in the successful bombing of German petroleum installations. On another occasion he reached the oil refinery at Leghorn while it was still under fire from German troops 200 yards away.

In January 1946 Mr. Hofland went to Germany as oil adviser to the British Military Government and also to represent Royal Dutch-Shell interests in Germany. He was appointed general manager of Deutsche Shell A.G. on Jan. 1, 1948.

Arnold Hofland
Photo courtesy Shell Photographic Library

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Dr. Siro Vasquez

Dr. Siro Vazquez

Dr. Siro Vasquez was appointed manager of the production department of Creole Petroleum Corp., early in November and succeeds M. S. Kendrick, who is a member of the management committee. Dr. Vasquez was graduated from the Central University of Venezuela as civil engineer in 1930 and then studied petroleum engineering in Tulsa, Oklahoma, where he completed studies for a degree in 1933. His first position following graduation was that of inspector for the Oficina de Hidrocarburos del Ministerio de Fomento with headquarters in western Venezuela. In September 1937 he joined Creole as petroleum engineer and has served the company ever since. In 1939 he was made assistant chief petroleum engineer of the eastern division with headquarters in Caripito, became division engineer in 1941, was appointed chief petroleum engineer in 1943 with headquarters in Caracas and became assistant manager in 1947, a position he held until the recent appointment as manager of Creole's production department.

WILLIAM SCHWARZ has been appointed general manager of refineries in Europe for California Texas Oil Co. He will establish an office in Paris to coordinate the refinery construction program in Europe and will probably live in Paris for the next two or three years.

Mr. Schwarz was graduated from Johns Hopkins University with a BSs in civil engineering and has been in the oil business for 20 years as a draftsman, foreman of the solvent and refining area, supervisor of lubricating oil manufacture and manager of the Lutramar SAPA refinery at Buenos Aires since 1944.

William Schwarz

Canadian Gasoline Quality Improves

Quality of gasoline marketed in Canada in the summer of 1947 had risen above the prewar level, according to the annual survey of the Canadian Bureau of Mines. The dip in octane rating caused by war restrictions was completely eliminated. Average rating of regular gasoline was 75 octane compared with 73.6 in 1946 and 70.3 in 1939. Average rating of premium gasoline was 79.2 octane compared with 77.8 in 1946 and 77.4 in 1939.

Volatility of summer gasolines also was increased. Reid vapor pressure of all samples averaged 8.6 pounds compared with 8.4 pounds in 1946 and 8.3 pounds in 1939. Fifty percent evaporated point was 237°F, compared with 238° in 1946 and 249° in 1939.

FRANK E. McCORKLE, former chief accountant at the Standard-Vacuum Oil Company's Japan office and an employee there since 1919, retired on Nov. 24, 1948. In early 1942 Mr. McCorkle was interned by the Japanese in Yokohama. In August of that year he returned to America with other repatriates aboard the Gripsholm and subsequently served in India and Shanghai before returning to Japan in 1946.

Tom Lumpkin

TOM LUMPKIN is manager of industrial relations for the Mene Grande Oil Company, C.A., with headquarters in Caracas, Venezuela. He accepted this position last October 1. Mr. Lumpkin is from Amarillo, Texas, and was graduated from the college there in 1933 and from the University of Texas in 1936. After a year of private legal practice in his home town, he became staff attorney there in the legal department for Phillips Petroleum Company and continued in this capacity until 1941. During the war years following, he was loaned to the State Department and was sent on special assignments to Venezuela and Colombia. At war's end he resumed legal work for Phillips Petroleum Company in Amarillo, where he remained until his transfer on Jan. 1, 1946, to the Bartlesville office. In April of that year he arrived again in Venezuela, this time as resident counsel for Phillips Oil Company with offices in Caracas. He relinquished this position last fall to become manager of Mene Grande's industrial relations.

1948-49 FBI Register

The 1948-49 edition of the FBI Register of Manufacturers has been published jointly by Kelly's Directories Ltd. and Iliffe & Sons Ltd. as a guide to members of the Federation of British Industries, their products and services. This latest edition lists products of 6,000 firms on its 1,000 pages. British orders for the Register should be sent to Kelly's Directories Ltd., 196 Strand, London, WC 2. Overseas orders must be addressed to Iliffe & Sons Ltd., Dorset House Stamford Street, London, SE 1. The price is 42/-, home and overseas.

JOHN A. WALSTROM and J. H. French have been appointed vice presidents of the Asiatic Petroleum Corp. Mr. Walstrom joined Asiatic in 1946 and became sales manager in 1948. He was formerly in charge of the petroleum section of the Federal Bureau of Supply, Treasury Department, and later was on active duty with the U. S. Navy as director of the theater division of the Army-Navy Petroleum Board. For his wartime services he was given commendations by the U. S. Army, the U. S. Army Air Forces and was awarded the Legion of Merit by the U. S. Navy. Mr. French joined Asiatic in 1917 and was appointed treasurer of the corporation in 1945, which office he still holds.

Joins Moore and Charlton

Bernard N. Darbyshire has joined the Moore & Charlton Group of Companies. Mr. Darbyshire previously held a post as a petroleum economist in the trade relations department at the head office of The Shell Petroleum Co. Ltd., London. After service with the Naval Intelligence Division, he joined the Royal Dutch Shell Group early in 1946. He subsequently transferred from the Anglo-Saxon Petroleum Co. Ltd., to the Shell Petroleum Co. Ltd. He now takes over the management of the London office of Harold Moore & Partners (Engineers) Ltd., and the representations of Moore & Charlton, the petroleum consultants.

Scientific Lubrication

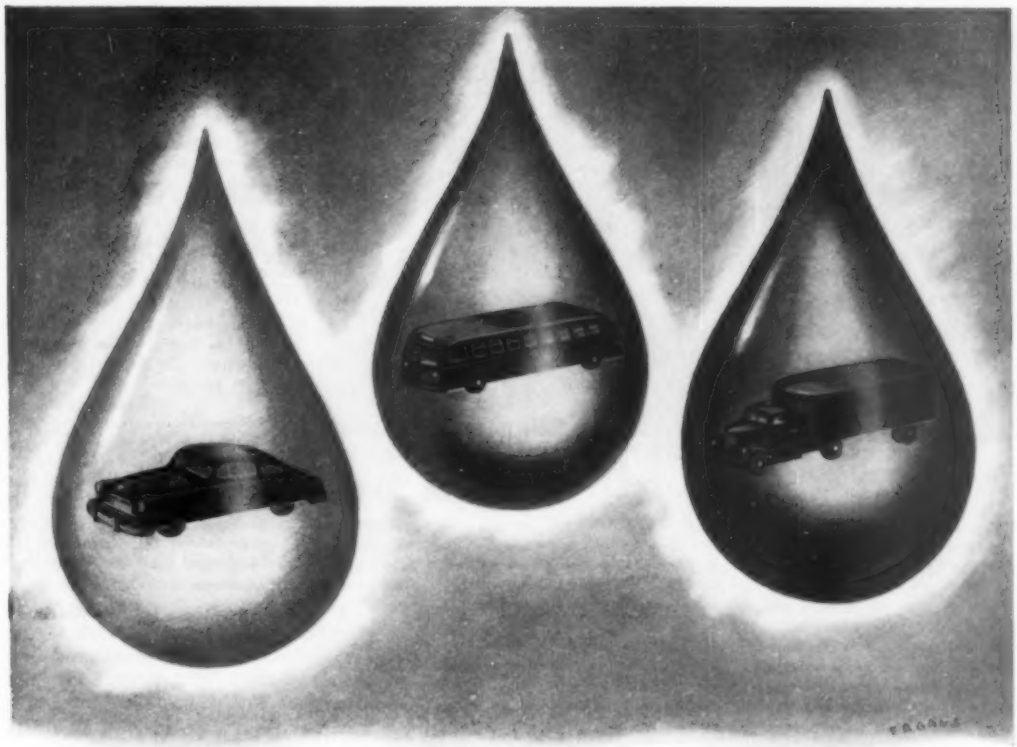
First issue of a new British publication, "Scientific Lubrication," made its appearance last month. As its name indicates, it is devoted to study and improvement of lubricants and their application to all branches of industry. The editor is E. V. Paterson, a prominent engineer and a member of the Institute of Petroleum. It is published by Scientific Publications at Wellington, Shropshire.

CHURCHILL T. SHELTON, for 21 years an oil production engineer in Indonesia with Standard-Vacuum Oil Co.'s producing subsidiary there, retired on Dec. 1. Mr. Shelton went to Palembang, Sumatra, in 1927 for Standard-Vacuum and was evacuated to the United States in 1942. Returning to Indonesia after V-J Day, he served with Standard-Vacuum's war damage committee, making extensive surveys of company losses in Java and Sumatra.

Ideco Makes Latin American Survey

George W. (Jack) Walton, vice president in charge of the machinery and export division of the International Derrick and Equipment Co., has left Dallas headquarters for South America. He will call on Ideco offices and representatives in Caracas, Buenos Aires and Rio de Janeiro. Field trips are contemplated in all important oil regions to observe Ideco equipment now in operation and to ascertain future South American equipment requirements.

George W. Walton



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OIL COMPANY STAFF CHANGES

Norman J. McGaw

NORMAN J. McGAW, vice president of Shell Oil Co., has been elected to the board of directors. Mr. McGaw will move from San Francisco to New York where he will organize and direct a new department dealing with economic studies of the oil industry and Shell development projects. He joined Shell as a clerk in 1925 and became assistant manager of manufacturing in 1932. Serving first in the president's office and later as manager of transportation and supplies, he was made vice president in charge of transportation and supplies in 1939. Since 1946 he has been general vice president in San Francisco.

F. C. SEALEY has advanced from general manager of the foreign producing department of The Texas Co. to assistant to the vice president. W. H. Farrand succeeds Mr. Sealey as general manager, J. P. McCulloch has been named assistant general manager, and W. A. Clark becomes manager (operations).

Mr. Sealey entered the service of the Producers Oil Co., former Texaco subsidiary, in 1917 as an assistant geologist and has held various positions in Texaco's producing department since his discharge from the army in 1919. He has been associated with the company's foreign producing activities since 1938. Mr. Farrand has been in the oil business since 1923 and has been associated with The Texas Co. since 1929, both in this country and abroad. He was appointed assistant manager of the foreign producing department in 1946.

Mr. McCulloch joined The Texas Co. in 1934 as a representative of the foreign producing department in France. In 1940 he became assistant to the manager, foreign producing department, and later manager (administration). Mr. Clark was employed by the company in 1929 at Santa Fe Springs, Calif., as an assistant engineer. In 1947 he was transferred to New York as assistant manager (operations), foreign producing department.

N. H. ANGELL of the Standard Oil Co. of California, was elected president and chairman of the executive committee of the Asphalt Institute at the annual meeting of the Institute's board of directors. Other newly-elected members of the executive committee include A. M. Maxwell, Standard Oil Co. of Ohio; Sidney Goldin, Shell Oil Co.; D. H. Jenks, Jr., Ashland Oil and Refining Co.; E. E. Scholer, Shell Oil Co.; W. L. Spencer, Union Oil Co. of California, and O. D. Bridges.

E. F. Battson

E. F. BATTSON will become vice president and manager of the Continental Oil Company's operations in the Rocky Mountain area on Feb. 1. He will succeed W. H. Ferguson, who will retire after 35 years of service with the company.

Mr. Battson joined Continental in 1922. He was appointed assistant to the president in 1946 and a vice president early in 1948. He is also a member of Continental's management committee and is chairman of the advertising committee.

Mr. Ferguson, although officially retiring, will continue as a member of the Continental board of directors. He also joined Continental in 1922 and served as a director and general counsel until his election as vice president in 1929.

A. ALLEN WEYMOUTH has been appointed chief geologist for American Independent Oil Co. He comes to American Independent from the Standard Oil Co. of Texas, where he was a development geologist.

EDWARD G. VOSS has been elected assistant treasurer of Arabian American Oil Co. He will make his headquarters in San Francisco. Mr. Voss started as an office boy with the Standard Oil Co. of New Jersey in 1934 and in 1946 was made head of that company's investment and finance division.

Edward G. Voss

GAGE LUND has been elected a vice president of Standard Oil Co. of California. Mr. Lund is chairman of The California Co. and the Standard Oil Co. of Texas, both wholly-owned subsidiaries of Standard of California operating in the Rocky Mountains, and of the Richmond Exploration Co., Standard's subsidiary operating in Venezuela. He joined Standard as a geologist in 1925, a year after his graduation from Stanford University.

W. A. MALEY has been named manager of the exploration department of Humble Oil & Refining Company. J. Ben Carsey was named chief geologist, Ed. J. Hamner was appointed California exploration manager, and Douglas E. Bell was promoted to head production geologist. Changes were made in view of the election of L. T. Barrow as chairman and the consequent increase in the responsibilities of Morgan J. Davis, director in charge of exploration.

Mr. Maley and Mr. Carsey both joined Humble in 1925. Mr. Maley has been division geologist with headquarters at Corpus Christi since 1937. Mr. Carsey has been division geologist in West Texas and Louisiana. In August 1946 he was named assistant chief geologist.

Ed Hamner was named an assistant chief geologist in 1926 after 14 years service with Humble. In his new assignment as Humble's California exploration manager, Mr. Hamner will have his headquarters in Los Angeles. Douglas E. Bell, new head production geologist, has worked principally on the Gulf Coast since joining the company in 1934. His most recent assignment has been as division geologist for Louisiana.

DELBERT Y. HEWITT of Mt. Pleasant, active in the Michigan oil industry for the past 16 years, has been elected executive vice president and a director of the Leonard Pipe Line Co. Mr. Hewitt resigned as executive vice president of Simrall Corp. several months ago to join Leonard. At the same meeting John J. Devine, acting general manager, was elected general manager and a director. He succeeds David E. Beach who resigned earlier in the year to organize a new oil development company in the southwest.

RICHARD S. STEWART has been named assistant to C. T. Foster, executive vice president of the Standard Oil Co. of Ohio. Mr. Stewart has been operations manager for Sohio's manufacturing department refineries and plants since 1945.

Wallace K. Bergen will succeed Mr. Stewart as operations manager with offices in Cleveland. He joined Sohio at the old Solad refinery in Lima in 1930, went to the Latonia, Kentucky, refinery in 1933 and in 1940 was transferred to the Toledo refinery where he became manager in 1945.

Richard S. Stewart

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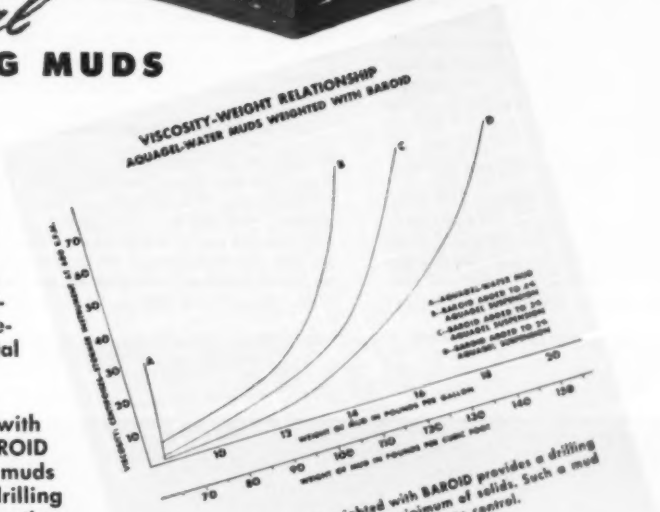

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PATENT LICENSES unrestricted as to sources of supply of materials, but on royalty bases, will be granted to responsible oil companies and others desiring to practice the subject matter of any and/or all of United States Patent Numbers 2,041,086; 2,044,758; 2,064,936; 2,094,316; 2,119,829; 2,294,877; 2,387,694; 2,393,165; 2,393,173; 2,417,307 and further improvements thereof. Applications for licenses should be made to Los Angeles office.

George C. Hargrove

Ralph D. Waterman

Named Badger Vice Presidents

George C. Hargrove and Ralph D. Waterman have been elected vice presidents of E. B. Badger & Sons Co., of Boston, a subsidiary of Stone & Webster, Inc. Mr. Hargrove has been with the company for 18 years and is vice president in charge of general administration and sales. Mr. Waterman joined the organization nine years ago and is vice president in charge of engineering and construction.

Reports of the Petroleum Committee

Reports prepared for the second session of the Petroleum Committee of the International Labor Office are being distributed by the Washington office of the ILO. These cover in much detail the results of inquiries into labor conditions in the world petroleum industry and outline recommendations that the Committee will be asked to lay before the governments of oil-producing countries to improve the conditions of workers in oil fields and refineries. The publication is in five parts: General Report; Recruitment and Training; Safety in the Petroleum Industry; Industrial Relations; Record of the First Session (Los Angeles, February, 1947). The set is priced at $2.20.

Wins Research Award

Research which inaugurated a new technique to predict engine deposits of sludge and varnish and bearing corrosion and which evaluates engine lubricants and gasoline when engine design factors and operating conditions are known, has won for Adolphus C. Pilger, Jr., Tide Water Associated Oil Co., the 1947 Horning Memorial Award of the Society of Automotive Engineers. Laboratory techniques for making these determinations have long been in use, but the new method produces highly accurate information largely because it can be set up as a permanent program. Presentation of the award will be made during the SAE annual meeting at Detroit this month.

E. M. Eckhart

Eldon M. Eckhart, 52, executive vice president of the J. M. Huber Corp., died suddenly on Nov. 28 at his home in Amarillo, Texas. He was in charge of Huber's carbon black and oil and gas operations with headquarters at Borger, Texas.

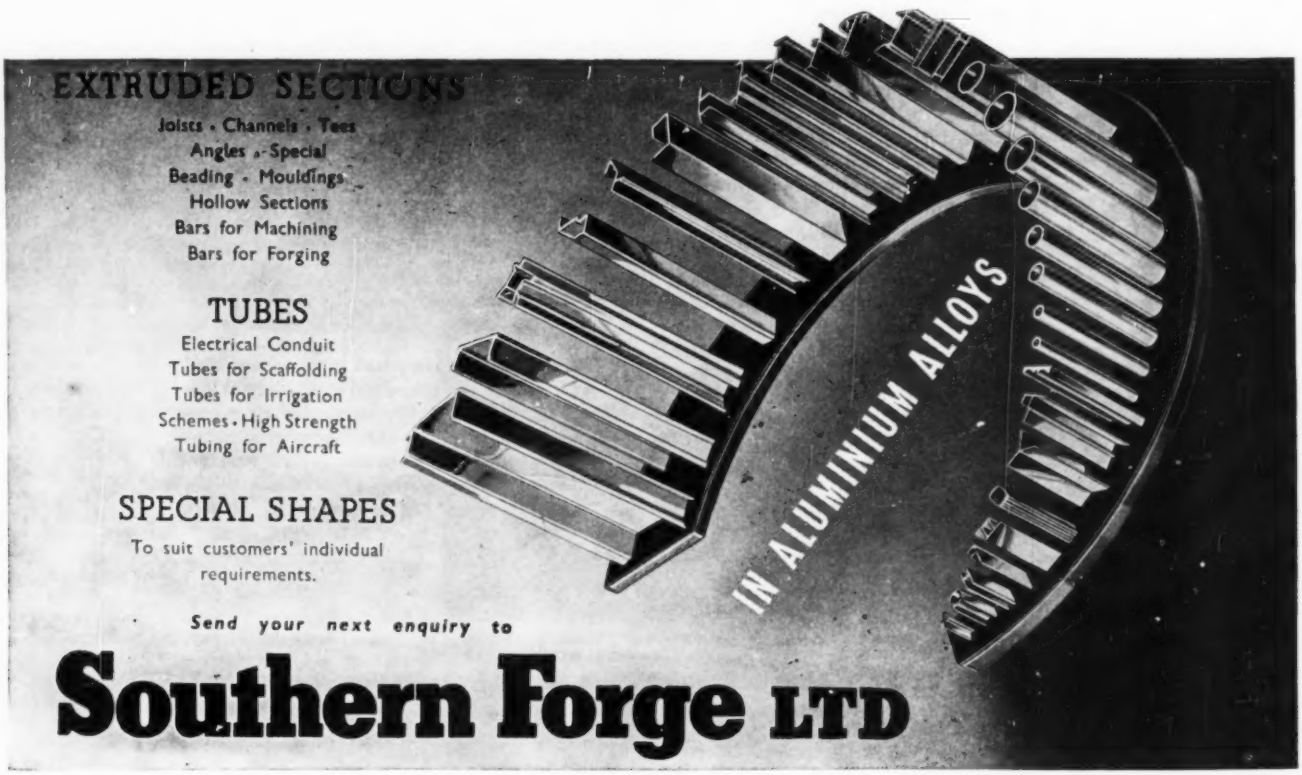
Fluor Corp. Appointments

Lee Van Horn has been appointed chief process engineer for Fluor Corp. Ltd., constructors and engineers. His headquarters will be in Los Angeles, and he will direct process research and engineering in connection with Fluor contracts in refining-plant construction. He has been connected with the development of refining processes for the past 20 years.

Harold Gearin has joined the company's sales staff and will act as sales coordinator among the various district offices on refinery and other construction projects. He previously held executive sales positions with the Shell Oil Co. and the Bendix Aviation Corp.

Slater Heads Kobe's Hydraulic Sales

W. F. "Pete" Slater, manager of general technical service division, Kobe, Inc., has been appointed to the newly-created position of manager of hydraulic equipment sales. As head of the general technical service division, he has been responsible for the training of Kobe field personnel and the direction of the company's field service work. In 1940, he joined Kobe, Inc., at Tulsa. In 1945 he was appointed manager of Kobe's general technical service division.



David L. Campbell

DAVID L. CAMPBELL has been appointed manager of all refineries for the British American Oil Co., Ltd. He will make his headquarters in Toronto, Canada. Mr. Campbell was graduated from the University of Saskatchewan with the degree of BScChE and joined B-A in 1934 as an instrument man. Before his recent appointment, he was manager of the Calgary refinery.

WARD O. LONGWORTHY, formerly mechanical superintendent of the Regina, Sask., refinery of Imperial Oil Ltd., has been appointed assistant superintendent of that refinery. Mr. Longworthy joined the staff of the Regina refinery in 1927. For several months prior to his present appointment he was acting assistant superintendent.

J. S. FEROE has been elected president of Beacon Petroleum Co., Tulsa. He succeeds E. Q. Beckwith who resigned to join the Sid Richardson Gasoline Corp., Ft. Worth, Texas. Mr. Feroe was associated with Hanlon-Buchanan, Inc., for 14 years before the organization of the Beacon company.

DR. RICHARD V. HUGHES has resigned as director of production research, for the Pennsylvania Grade Crude Oil Association, a position he has held since 1944. Dr. Hughes has accepted a research and teaching position at Stanford Research Institute, a division of Stanford University. His successor has not been named.

J. B. RATHER has retired after 40 years in technical departments of Socony-Vacuum Oil Co. He joined the company as assistant chief chemist in 1918 and became chief chemist a year later. He was subsequently general manager of research and development and in recent years has been technical adviser to the manufacturing committee.

JACK H. RICE has been appointed Wyoming division superintendent of Ohio Oil Co.'s pipeline department. He succeeds R. M. Sackett who is in ill health. Mr. Rice has been Mr. Sackett's assistant.

THE FISH ENGINEERING CORP., Houston, has been awarded a manager-constructor contract for the 1,839-mile Trans-Continental Gas Pipe Line Corp. gas line from Hidalgo County, Texas, to New York City, the 340-million cubic foot line will consist of 1,210 miles of 30-inch pipe, 558 miles of 26-inch pipe and 71 miles of 20-inch. The line will cost about $200 million when complete.

Initially ten compressor stations with 72,000 horsepower will be installed. When the line capacity is increased to 500 mmcf., nine more stations with 150,000 additional horsepower will be required. First gas deliveries are planned for November 1950. Gas sale contracts have been signed with various companies in the New York area. Supply contracts are backed with reserves totaling four trillion cubic feet in Texas and Louisiana.

Joins Export Sales Staff

Joseph W. Chanda has joined the sales staff of the international division of the A. O. Smith Corp. He will specialize on sales of electric motors. Formerly on the staff of the American Exporter as an account executive and foreign trade adviser, he is experienced in the export and small tools and power tools fields.

Joseph W. Chanda

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Super-Tanker Launched

The 26,000-ton super-tanker, Esso Zurich, was launched by the Sun Shipbuilding and Dry Dock Co. Dec. 4 for Standard Oil Co. (N.J.) The ship has an overall length of 628 feet and will carry 230,997 barrels of oil.

The Esso Zurich is a forerunner of a number of similar vessels now under construction. It was designed jointly by Sun and Standard and is the largest tanker ever constructed on the Delaware. Following are its dimensions: length, overall, 628 feet; length, B.P., 600 feet; breadth, molded, 82½ feet; depth, molded, 42½ feet; draft, designed 31½ feet; deadweight, 26,000 tons on 31½-foot draft; speed, 16 knots; S.H.P., 12,500 normal; liquid cargo capacity, 230,997 barrels; dry cargo capacity, 53,160 cubic feet; fuel oil capacity, 18,467.

The vessel has two longitudinal bulkheads, the full length of the cargo oil tank space. It is of the two-island type with poop and forecastle decks, cruiser stern and a curved bow.

The propelling machinery consists of one set of General Electric geared turbines of 13,750 max. S.H.P. driving a 20-foot-diameter propeller at 112 rpm. Two Babcock and Wilcox straight tube coilers work at 850 psi and 850°F temperature. Cargo pumps have a capacity of 23,400 barrels per hour which will discharge the vessel's cargo in less than 10 hours, the cargo lines being 14 inches in diameter and the stripping lines six inches. The deck machinery consists of one electro hydraulic steering gear, five steam winches and one steam windlass capable of raising two 15,500-pound anchors simultaneously. Appliances for safety of life at sea include radar, radio direction finder, gyro pilot and compass.

The vessel is intended for the company worldwide service and has been provided with the most up-to-date method of handling cargo expeditiously. As a comparison of this vessel with the famous T2 tanker designed by Sun, the T2 had a carrying capacity of 141,000 barrels, a displacement of 21,780 tons, deadweight of 16,600 tons and speed of 15 knots.

$19 Million Expansion Completed

A $19 million expansion program has been completed by Gulf Oil Corp. at its Port Arthur, Texas refinery. New construction includes a desulfurization unit, a polyform unit, three atmospheric-vacuum topping stills and an extension of docking facilities. The new installations could increase the refinery's crude charging capacity by 66,000 barrels a day. At present, however, the desulfurization unit and polyform unit will be operated to produce a higher quality gasoline from straight-run gasoline naphtha fractions and light hydrocarbons.

S. W. Collins Joins Ideco

George W. Walton, vice president in charge of machinery and export division of Ideco, announces that S. W. "Sandy" Collins, formerly west Texas district manager for the Hinderliter Tool Company, has joined the International Derrick and Equipment Company to become New York division sales manager. Mr. Collins has been in oil well equipment sales for the past twenty years. He will work with A. L. Woracek and B. V. Brown who are now in Ideco's New York office.

Co-ops Buy Interest in Refinery

Three eastern farmer cooperatives have purchased interests in Petrol Refining Inc., operating a plant at Texas City, with a current production of 17,000 barrels daily. Partners are Petrol Terminal Corp., headed by E. M. Callis, of Baltimore; Southern States Cooperative, Richmond, Va.; Pennsylvania Farm Bureau Co-op Association, Harrisburg, Pa., and Cooperative Grange League Federation Exchange, Ithaca, New York. Petrol is a $10 million Delaware corporation with headquarters in Baltimore, Md. The company also operates three T-2 tankers.

Surveying Steel Requirements

P. D. Thomas of Jones & Laughlin Steel Corporation and F. T. Hayward of United States Steel Export have been spending several weeks in Venezuela and Colombia making independent surveys of oil industry requirements in the way of pipe and structural steel in the two countries.

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AGENTS THROUGHOUT THE WORLD

New Book: Submarine Geology

Not so long ago a knowledge of submarine geology did not seem to be of much importance to man's economic welfare. There had long been a science of oceanography which could find little to do beyond taking soundings from which a topographic map of the ocean floor might be prepared, charting the great ocean currents and collecting samples of submarine deposits and living organisms that might be brought up by dredging.

Real economic interest in what might lie under the open sea, particularly under the continental shelves is a very recent development which has given rise to a need for a work on submarine geology. A first attempt to provide such a work has now been made by Francis P. Shepard in his book, "Submarine Geology," (Harpers, New York, 1948). Dr. Shepard of necessity confines himself to what can be found out by operations conducted from the surface, but these observations include a great deal that will be of use to the geologist who goes seaward. He describes all the methods used for exploring the ocean floor and devotes much space to waves and currents which certainly must be taken into account, and discusses the origin and history of the various continental shelves, their configurations, topography and the sediments that are found on them; from there on concerns himself with an informative description of continental slopes, submarine canyons, coral reefs and the floor of the deep ocean.

A useful feature of the book is the discussion of the instrumentation of sea floor research. Echo sounding machines are a ready means of obtaining permanent and detailed records of depths, and devices such as radar, Loran and Shoran assure good means of fixing locations. It is now possible to obtain cores of the surface deposits by which something may be learned of the nature of submerged rock formations. Devices have been perfected for obtaining a series of photographs of the bottoms of shallow waters from a vessel underway at speeds up to 15 knots; some of these photos show the strike of uptilted beds of a submerged sedimentary rock. There are devices which project on a screen a profile of the sea floor in front of an advancing vessel. Beyond these is the fact that geophysical prospecting has begun to yield information about the thicknesses and conformations of sediments which overlie the rock floor of the ocean.

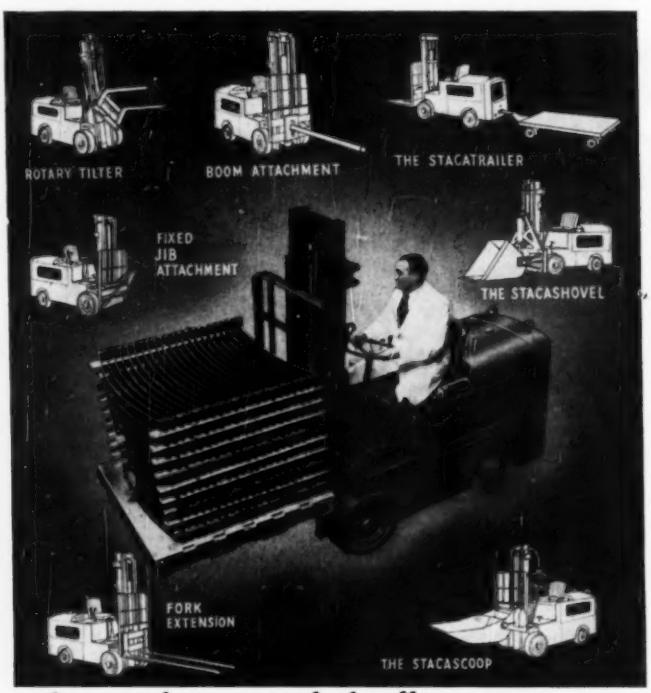
As regards continental shelf investigations and oil possibilities, the new submarine geology has rendered a service in dispelling the old notion that the continental shelves are composed largely of sediment embankments built out over the deep ocean bottom. Oil accumulations would be unlikely in the recent seriment of wave-built terraces. On the other hand the discovery that the shelves have extensive outcrops of rock at all distances from the coast, and especially the discovery that these rocks are sedimentary and Cretaceous to late Tertiary in age, add immensely to the possibility of finding oil. The discovery of a row of hills on the outer shelf west of the Mississippi delta indicates the probably presence of salt domes. Since salt domes are also known to underlie parts of the Mississippi delta where it has been built over the continental shelf, such domes may reasonably be expected in other places where the shelf has not been overlapped by the delta. Geophysical work off the Gulf and the east coasts has produced evidence that the shelf may be a geosyncline of deposition, suggesting the possibility of oil structures in this place.

Studies on the continental shelf have contributed something to the understanding of stratigraphic problems relating to exploration for oil on land. The discovery of extensive areas of non-deposition on the submarine shelves and slopes shows that nonconformities do not necessarily imply withdrawal of the sea. Further, discovery that sediments on the continental shelves do not decrease in grade size as they extend outward should cause petroleum geologists to hesitate to use variations in sediment texture as a sign of shorelines in ancient sediments.

The problem of determining the position of potential oil traps under the continental shalves does not now appear so formidable as it did a few years back. Seismic, gravimetric and magnetic methods can be employed almost as easily through the water as they can on the land. Reconnaissance of the topography of the shelf can easily be carried out by running a network of echo sounding lines across a selected area.

If there are tilted layers of rock, they will be indicated by slight rises in the bottom profile; these rises show the strike, and the dip may be determined from the asymmetry of the ridges. With this preliminary information in hand, a check may be obtained by sending down a geologically instructed diver to collect samples, measure dips and strikes, and take photographs. Such operations can be carried on to depths The science of submarine geology is still very new. It does not yet have a great deal to show; but what it has will be of interest to oil prospectors who venture out on the continental shelves, and it can give new pointers even to dry-land geologists on how to interpret observations.

"MOLYBDENUM: STEELS, IRONS, ALLOYS"; published July, 1948, by Climax Molybdenum Company. The varied applications of molybdenum as an alloying element are described in this book, which



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covers a wide range of materials from wrought to cast steels and from cast iron to nonferrous alloys. The major emphasis has been placed on the presentation of the fundamentals that must guide all engineers, designers and metallurgists in their selection of the most suitable materials for a given application. Considerable recent information is included, not only on the more prominent developments, such as the gas turbine steels and alloys, but also on the work that has served to clarify the factors affecting the service life of the lower alloy steels.

New Book

The Conversion of Petroleum; Production of Motor Fuels by Thermal and Catalytic Processes; by A. N. Sachanen (Socony-Vacuum Co.); second edition, published 1948 by Reinhold Publishing Corp.; 602 pages, $11.00.

The first edition of this book appeared in 1940 when annual catalytic cracking capacity was 100,000 barrels and alkylate 10,000 barrels daily. Spectacular developments have arisen since then: motor gasoline from natural gas, polyforming and other new refining processes such as those which contributed to the manufacture of synthetic rubber and various chemicals. This progress has made a new edition necessary. A number of chapters have had to be revised and rewritten, particularly on the reactions of hydrocarbons, motor fuel from gas and catalytic cracking.

Aid for Advertisers

A guide for American business firms advertising in foreign countries who wish to use their newspaper and magazine space and radio time to correct misconceptions about the United States and to explain the motives of economic aid to other countries, was issued recently by the Advertising Council, 11 West 42nd Street, New York 18, N. Y. The booklet was prepared because of numerous requests for advice from industries using foreign media and publications distributed overseas. It is the result of many conferences between officials of the Advertising Council, the State Department and the Department's foreign area experts.

Early Days of Oil

Adding to his many past services to the oil industry, Paul H. Giddens, curator of the Drake Museum and author of a well-known book, "Birth of the Oil Industry," has brought out a new volume, "Early Days of Oil," reproducing several hundred photographs depicting characteristic scenes in the stirring developments of the industry's beginnings in western Pennsylvania.

As the author explains in his preface, the American public is indebted for the permanent pictorial record of one of the most remarkable industrial eras in the country's history mainly to the activities of John A. Mather, a photographer who settled in Titusville in 1860 and remained there for the rest of his life. Oil evidently held a fascinating interest for him, and from his small Titusville gallery and from traveling studios which he equipped, one on a flatboat and the other in a wagon, he portrayed the shifting fortunes of the infant oil business, the rise and fall of boom towns, early fields and transportation methods when oil was moved in barrels by flatboat or in wagons hauled over almost impassable roads. He also made many portraits of men who played leading roles in the fast-moving panorama of the time.

Of the vast number of photographs made by Mather, several thousand were lost in floods and fire, but something over 3,000 have been preserved and collected from various sources and are now housed in the museum at Drake Memorial Park. From among this number Prof. Giddens has selected the most representative, accompanying them with brief explanatory text and titles. In the main, however, the pictures are relied upon to tell the story, and they will be of keen interest not only to oil men but to all who would inform themselves on the hectic period to which they apply.

Early Days of Oil; by Paul H. Giddens; 150 pp., 365 illustrations, Princeton University Press, $6.00.

Porosity of Limestone

"The Nature and Origin of Limestone Porosity" by Richard B. Hohlt is a recent publication of the Colorado School of Mines, Golden, Colorado. The author analyzes the existing concepts of carbonate porosity and the hydrology of limestone terranes which are discussed in view of questions raised by modern petroleum practices. The publication has 52 pages, 20 photomicrographs and diagrams and is priced at $1.00.

Pipe Line Cleaning Tools

T. D. Williamson, Inc., Tulsa, has prepared a booklet describing a large variety of pigs for cleaning, salt water disposal, crude, products and gas pipe lines. Sizes are available up to 30 inches in diameter equipped with wire brush type or scraper type cleaners. Special types have been made to pass through certain types of valves and to traverse 30° miter bends. Batching pigs to prevent contamination and for other special purposes are described along with other specialties manufactured by the company.

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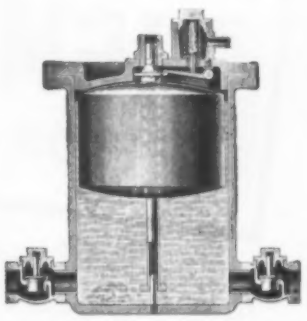

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At Duncan, Oklahoma's oil appreciation banquet: standing L to R: Dr. H. B. Alspaugh, vice president of Rock Island Refining Co., and F. L. Martin, vice president of Sunray Oil Corp. Seated L to R: Senator Ed Moore of Okla., W. G. Skelly of Skelly Oil Co., and Earle P. Halliburton of the Halliburton Oil Well Cementing Co. Photo by Bill Terrell.

Oil Appreciation Week

A banquet for 850 climaxed four days of festival at Duncan, Okla., Nov. 18, in which citizens of that city and Stephens County paid tribute to the oil industry in "Oil Appreciation Week." The city and county are among the most prosperous in the state as a result of the oil refining industry, the headquarters and main plant of Halliburton Oil Well Cementing Co., and the daily production of about 72,000 barrels of oil.

As part of the celebration, the oil industry held open house for 35,000 visitors; special films were shown, and radio programs told of the part oil is playing in modern life. Speakers at the banquet included R. M. Chan, vice president of Magnolia Petroleum Co., Dallas; W. G. Skelly, president of Skelly Oil Co., Tulsa; and Oklahoma's retiring senator and oil man, E. H. Moore.

Detection of Toxic Metals

A new instrument capable of detecting lead in the air in amounts as low as one part in 20 million recently was described by Henry Aughey of the chemical department of E. I. du Pont de Nemours and Co. The instrument's extreme sensitivity can be maintained, he said, in routine operations in which determinations of lead content can be made almost instantaneously. It gives promise of utility in detecting other toxic metals in the air.

The new instrument draws air through a tube in such a way that it passes through an electrical spark discharge. Light coming from the spark discharge is passed through a quartz spectrograph, the band of light from which is passed into a photoelectric Geiger counter.

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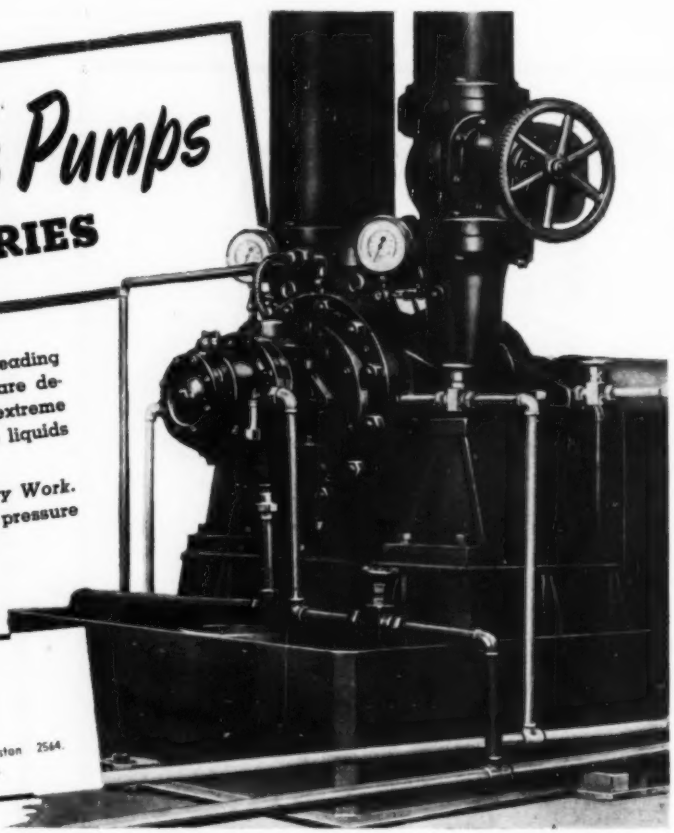

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Prepared by Technical Reports Section Synthetic Liquid Fuels Research and Development Div. of the Bureau of Mines at Pittsburgh

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Standard Practices for Stationary Diesel Engines

Published by the Diesel Engine Manufacturers Association.

• The 1948 Spanish edition of this book is invaluable to those who sell, buy, use or specify Diesel engines in Spanish-speaking countries. Before translating the English edition the committee of engineers from the Association rechecked it thoroughly and added some new and useful data. $7.50

Petroleum World Annual Review

• A detailed compilation of all significant statistics of the California oil industry, including production, refining and sales figures.
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Rotary Drilling Handbook

By J. E. Brantly

• New revised 4th edition, a 547 page book of hard facts for the practical man on the rig, outlining the selection and operation of modern equipment. Reference tables and simple formulas for determining every operation on a rotary well, with special emphasis on rotating speeds and drilling weights, calculations for mud control, pump pressures, etc.
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By Frederick H. Lahee

• This well-known field manual has been thoroughly revised to keep pace with the latest methods of geographical exploration and mapping, particularly those methods that have been developed to meet the needs of the petroleum industry. Fourth edition, 853 pages, pocket-size, flexible, 538 illustrations $5.50

The Chemistry of Petroleum Derivatives

By Carleton Ellis

• A comprehensive work, encyclopedic in scope, which offers a source for up-to-date information for the organic chemists and technologists in the petroleum and related industries as well as all concerned with the development and utilization of natural gas and petroleum and their chemical derivatives. 50 chapters, 1,285 pp. Illustrated $20.00

The Practice of Lubrication

By T. C. Thomsen

• An engineering treatise on the origin, nature and testing of lubricants; their selection, application and use—illustrated with 232 charts and diagrams. This is an extensive work, covering in its 638 pages (6 x 9 inches) probably every phase of industrial applications of oils with which the lubricating engineer is likely to come in contact.
Third Edition $6.50

Fundamentals of the Petroleum Industry

By Dorsey Hager

• An introduction to the petroleum industry in all its phases, for all who want a check on effective methods of management and engineering in the production and marketing of oil. 133 Ill. 445 pp. Pub. 1939 .....$4.00

Conversion of Petroleum

By A. N. Sachanen

• Dealing with the production of motor fuels by thermal and catalytic processes, this book comprises a complete discussion of the most recent discoveries in the field of petroleum conversion. It covers such topics as production of high octane motor and aviation fuels, degumming agents, tetraethyl lead, hydrogenation, the Houdry process and other recent developments. 413 pp. Ill. $6.75

Petroleum Production Engineering
Oil Field Development Vol. I

By Lester C. Uren

• A textbook on the technology of oil field development and petroleum production. 531 pp. $7.00

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• This is the first and to date the only book to bring the technical fundamentals of aviation gasoline manufacture in convenient form for chemists and engineers; it gives the chemistry of aviation fuels, flow diagrams, operations yields, commercial aspects, etc. 275 pages, 39 illustrations, 82 tables. $3.00

Chemical Technology of Petroleum

By A. W. Gruse and D. R. Stevens

• A manual that helps investigators and advanced students find their way about in the science and technology of this most recent and most intriguing of the great organic raw materials. 6 x 9. 725 pp. $8.00

Petroleum Refinery Engineering

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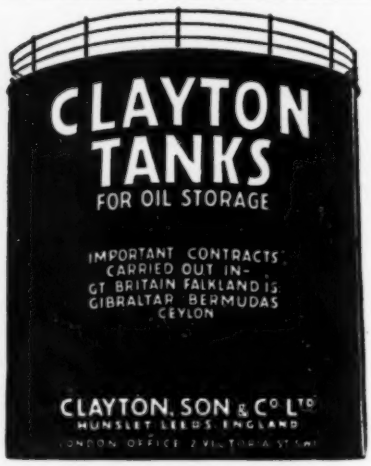
M. V. "British Workman" Launched

The "British Workman", a new 12,000-ton motor driven oil tanker for The British Tanker Co., Ltd., was launched Nov. 16 from Messrs. Harland and Wolff's Govan shipyard. A sister ship, the "British Strength", built at the Belfast yard, has completed her sea trials and has been handed over, while seven further tankers for these owners are under construction or have to be laid down at the company's Belfast and Govan shipyards.

The new vessel is constructed on the combined longitudinal and transverse system of framing with two longitudinal bulkheads divided by transverse bulkheads into 27 oil carrying compartments. Length between perpendiculars is 463 feet, moulded width 61 feet six inches, moulded depth 34 feet.



The vessel is propelled by a six-cylinder, single-acting, four-stroke diesel engine, having cylinders 740 mm. and stroke 1500 mm. working on the under piston system of pressure induction. The engine is conservatively rated and provides the necessary power at 115 rpm.

To Enlist Marketers

Greater emphasis will be placed in 1949 on getting participation in its information program by oil marketers who are in direct daily contact with the consuming public, it was decided by the Oil Industry Information Committee after a recent meeting in New York. Twenty of the OICs 26 members attended a four-day session to prepare plans for the year's program.

Objectives of the committee are to advance the common interest of all oil men in maintaining a competitive industry to serve the public; to increase the knowledge among oil men of the social significance of functions performed by their industry; and to further the public understanding of the oil business and of the people who work in this progressive industry.

Tide Water Observes 70th Anniversary

Luncheon gatherings in cities throughout the country and a message from President William F. Humphrey to stockholders, employees, distributors and dealers marked the 70th anniversary of Tide Water Associated Oil Company late last year.

Initial company in the Tide Water organization was the Tide Water Pipe Co. Ltd., which was formed in 1878 to build an oil pipe line from producing fields in western Pennsylvania to a refinery at Bayonne, N. J. Tide Water Associated Oil Co. was organized in 1926 as a holding company controlling Associated Oil and Tide Water Oil Co. of the east and mid-continent. Tide Water Associated changed from a holding basis to full operating basis in 1936 with operations centralized in three units—eastern, mid-continent and western divisions.

U. S. Oil Refinery Capacity

Petroleum refineries of the United States had a rated operating capacity of 6,034,252 barrels of crude oil per day at the beginning of 1948, an increase of nearly a half-million barrels daily compared with a year previous, according to the latest annual survey of petroleum refineries and cracking plants issued by the Bureau of Mines. At the start of 1947, the daily crude oil capacities totaled 5,569,482 barrels daily.

The daily capacity of installed facilities to produce cracked gasoline also increased during 1947, from 1,514,622 barrels on January 1, to 1,624,148 barrels on January 1, 1948, a rise of 109,526 barrels daily, the bureau report disclosed. A free copy of the report, Information Circular 7483, "Petroleum Refineries, Including Cracking Plants, in the United States, January 1, 1948," may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa.

New Steel Building Catalog

International Derrick and Equipment Co. has published a new 32-page catalog on Ideco steel buildings. It describes in detail and gives specifications of the many types of buildings that can be erected from standardized, mass-produced special ribbed parts.

Sun Expands Production Activity

Sun Oil Co. has established new production district offices at Amarillo, Texas, and Roswell, New Mexico, in extending its research for new sources of crude oil in these areas. Acquisition of extensive acreage in these areas during the last year prompted the move.

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14th REPEAT ORDER FOR GOLDFIELD. Ashanti Goldfields Corporation Ltd., have recently placed yet another order for Crossley-Premier Engines. The new engine is a 1100 B.H.P. Oil Engine and will be the 18th Crossley-Premier Engine in their power plant.

12TH REPEAT ORDER FOR AUSTRALIAN MINE. One of the seven new oil engines now on order for the New Consolidated Gold Fields, Ltd., is for The Lake View and Star, Ltd., and will be the twelfth repeat order for this mine.

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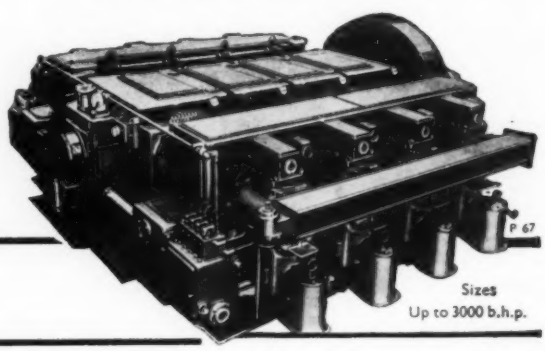

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A third district office in this area is located at Midland, Texas. Last March the company opened a new division office at Denver, Colo.

Simeon B. Christy, formerly of the Denver office, has been appointed manager of the Roswell district, and W. J. Hardy, former manager of the land office at McAllen, Texas, will be manager of the new Amarillo district. J. E. Regent, former manager of the Midland district will succeed Mr. Christy at Denver. J. B. Hamilton, district superintendent of production, will supervise production operations in west Texas and New Mexico from headquarters in Midland, Texas.

G. E. Opens California Motor Plant

A $3 million motor manufacturing plant, which at peak production will be able to turn out more than 1,500 electric motors weekly, was opened recently by the General Electric Company at San Jose, Calif. The San Jose factory allows for multiple expansion of the present building, and ultimately will produce all of the company's output of single-phase capacitor integral motors.

Buys Orinoco Oil Assets

Mene Grande Oil Co., Venezuelan subsidiary of Gulf Oil Corp., has purchased all the assets of Orinoco Oil Co., Venezuelan company in which Pure Oil Co. held a 75 percent interest. The remaining 25 percent, also acquired by Mene Grande, was sold by a group of Venezuelan investors.

The Orinoco property comprises 61,400 acres of leases located about 25 miles northwest of Maracaibo and between the LaPaz area and Mara field. Two producing wells on the tract are currently flowing about 325 barrels daily.

R. W. Parker

R. W. PARKER has been appointed assistant chief engineer, construction and maintenance, for California Texas Oil Co. After graduating from the University of British Columbia in 1923, Mr. Parker worked for General Petroleum, Union Oil Co. of Calif. and C. F. Braun until 1930, when he joined Standard Oil Co. of Calif. In 1945 he was appointed chief engineer of the manufacturing department, from which he was transferred in 1947 to the position of assistant chief engineer of general engineering, a position he held until his present appointment with Caltex.

New Records by Trinidad Leaseholds

Continued expansion in every direction was reported at the 35th annual meeting of Trinidad Leaseholds Ltd., held in London. Brigadier R. S. G. Stokes, chairman, reported a record refinery throughput for the year, the extension of exploratory drilling with some encouraging results, and the formation of the Regent Oil Co. Ltd., upon the dissolution of the Petroleum Board for the expansion of marketing facilities in the United Kingdom.

Named Works Manager

Willard A. Emery has been named new works manager of the Western Supply Co., Tulsa. Prior to joining Western, Mr. Emery was assistant plant manager of the Worthington Pump and Machinery Corp.'s Holyoke works.

New Cracking Run Record

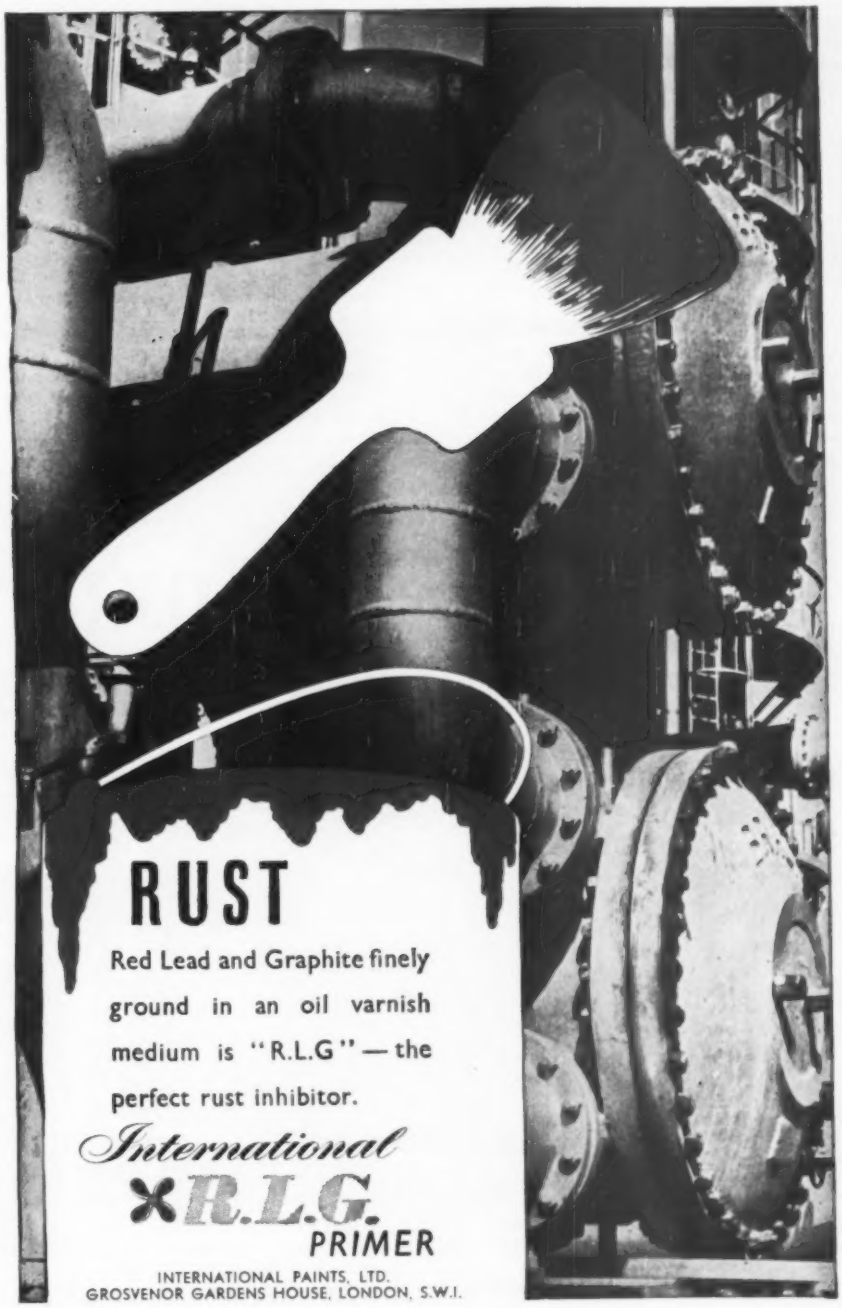
The world's record for length of run without a clean-out has been made by the Dubbs unit of the No. 1 plant of the Ashland Oil & Refining Co. refinery near Catlettsburg, Ky. The unit operated a total of 213.58 days, or 5,126 hours, without having ever been disassembled for cleaning or repair work. The previous record, slightly less than 171 days, was made earlier this year at a refinery in Oklahoma.

Heads West Coast Sales

L. T. Ratliff has been named California district manager of Mid-Continent Supply Company. He will handle the company's export and West Coast business.

To Build Lube Barge

Lake Tankers Corp. of New York, has ordered one 8,900-barrel lubricating oil barge from Dravo Corp. A hopper-type unit, 240 by 40 by 12 feet in size, the barge will have six cylindrical oil tanks installed in the hopper space and will be equipped with heating coils, piping and pumping equipment.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Pipe Liners Club of Tulsa

Pipeliners from ten companies in the Tulsa area have organized a technical and operating club known as The Pipeliners Club of Tulsa. The club is now meeting monthly at dinner.

J. L. Cahill, chief enginer of Continental Pipe Line Company, Ponca City, is president of the club. P. L. Reichard, assistant general superintendent, Gulf Refining So., Pipe Line division Tulsa, is vice president; F. C. Whiteside, assistant chief engineer, Interstate Oil Pipe Line Co., Tulsa, is treasurer; and J. D. Jones, master mechanic, Gulf Refining Co., Tulsa Pipe Line Division, is secretary.

Converting Six LST's

Shell Caribbean Petroleum Co. is converting six former tank and troop landing ships to crude oil carriers for the shuttle run between Lake Maracaibo and the new Shell refinery at Cardon. They will make the 300-mile round trip in approximately 60 hours, including loading and discharging. The ships will carry approximately 28,000 barrels of crude oil each. The conversion will be completed in February by Todd Shipyards Corp.

Pyeatt Joins Aeroquip

L. E. Pyeatt has been appointed sales manager of Aeroquip Sales & Engineering, Inc., distributors of flexible hose assemblies and self-sealing couplings, Fort Worth, Texas. Mr. Pyeatt was formerly associated with Mid-Continent Supply Company as district manager in Los Angeles.

Shell Research Expenditures

Royal Dutch-Shell will spend six million pounds on research work during 1949. The program embraces fundamental research and all phases of research into petroleum, extending from the initial prospecting for crude oil to the use of all kinds of petroleum fuels, lubricants and other final products. Increasing attention is to be paid to the application of petroleum products in agriculture, especially in connection with problems arising in tropical areas. Shell now employs about 4,000 employees on research activities.

Sunray Takes Canadian Leases

Sunray Oil Co., two other American oil companies not named, and Canadian oil interests have acquired a government concession on approximately four million acres in Alberta province. Sunray and its American partners have acquired a 60 percent interest in the property. Pacific Petroleums Ltd. of Calgary, and its associates in 20 companies, each hold limited acreage and have a 40 percent interest. The operating unit will be known as the Bear Oil Co.

Book on Synthetic Petroleum

Synthetic Petroleum from the Synthine Process, by B. H. Weil and J. C. Lane; published 1948 by Remsen Press, Brooklyn, N. Y.; 303 pages; $6.75.

This book is launched as the first systematic treatise in book form devoted exclusively to the fast-moving subject of producing synthetic petroleum by the now numerous variants of the Fischer-Tropsch process for artificially obtaining oil from carbon monoxide and hydrogen. The copious subject matter which the authors have collected is organized to show what is known and done in production of synthesis gas, the catalytic synthesis reactions, the resulting products, by-products and derivatives, and the basic economics of the proposition. There is a final chapter on the current situation, giving some particulars of nine private projects in the United States and a summary of governmental research. Numerous authorities and patents are cited. There is a good index. Workers in this field will find the book of interest.

Non-Inflammable Hydraulic Fluid

Standard Oil Co. of California, has announced development of a hydraulic fluid for planes which will not ignite at temperatures up to 5,000°F. The fluid is a petroleum product made from natural gas. The product retains desired viscosity characteristics from minus 70 to plus 250°F, is non-corrosive and lubricates at pressures up to 3,000 psi.

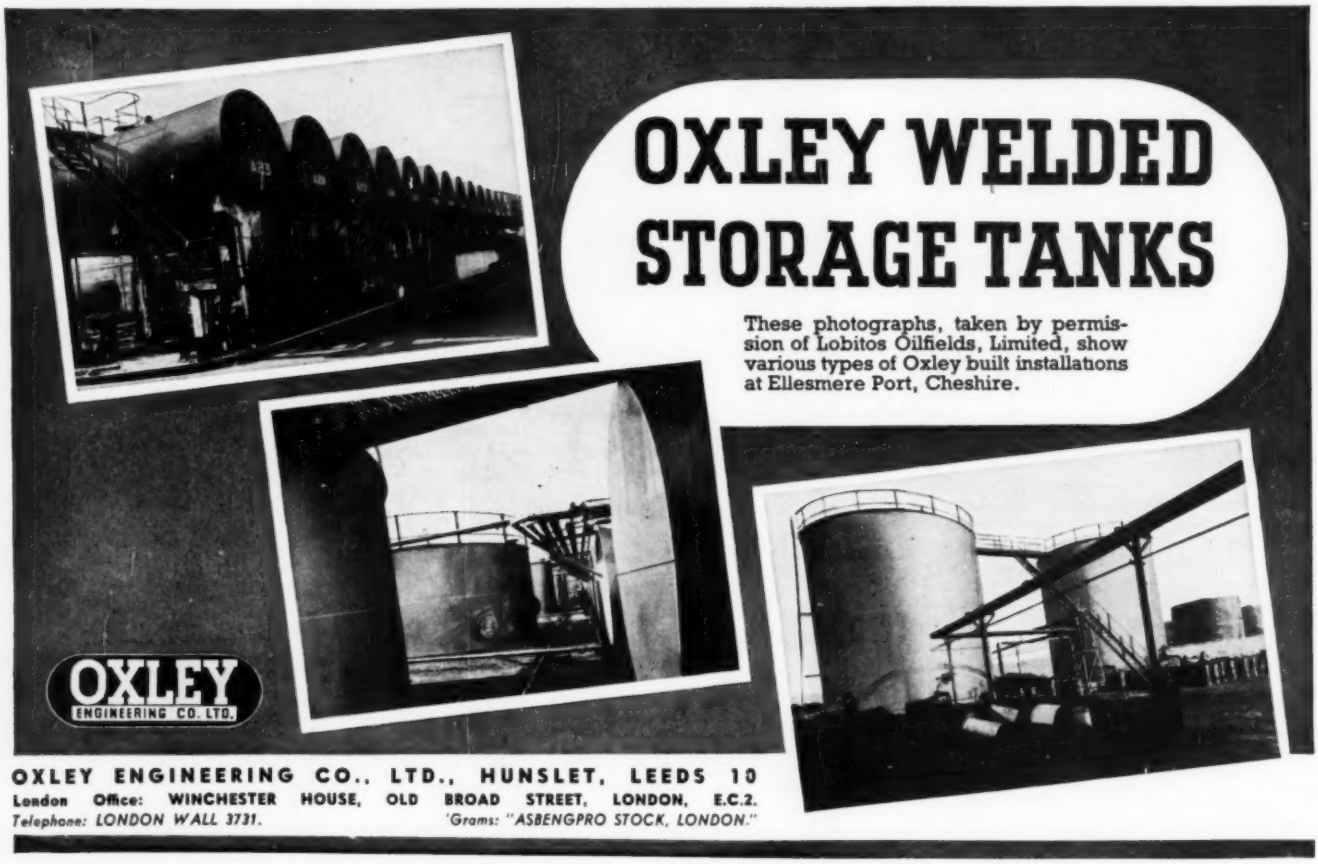
M. H. SHANAHAN, formerly assistant manager of the production department of Continental Oil Co., has been appointed to the newly-created position of senior consultant. Glenn C. Clark, formerly chief geologist, has been appointed to the newly-created position of senior chief geologist. Mr. Clark is succeeded by J. A. Culbertson, formerly assistant manager of the geophysical department; and S. K. Clark, formerly chairman of the exploration committee, is appointed to the newly-created position of coordinator of exploration activities.

Catalyst List

A list of catalysts marketed by Enjay Co., Inc., with principal characteristics and usage has been prepared for distribution as Product Information Bulletin T-1. The list is of especial interest to refiners engaged in hydroforming of naphtha fractions, catalytic reforming and aromatization. Copies are available on request to the company at 15 West 51st Street, New York.

New Petrochemicals Directors

Sir Robert Robinson, F.R.S., president of the Royal Society, and W. L. Tregoning, industrial adviser to the Finance Corporation for Industry, Ltd., have joined the board of Petrochemicals, Ltd. Sir Robert Robinson has also joined the board of Petrocarbon, Ltd., an associated company.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